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CARE OF PATIENTS WITH SURGICAL DISEASES OF THE CHEST

GEORGE R. MINOR, M.D., Ann Arbor, Michigan

THERE are many nonoperative considerations in the surgery of the thorax which can be neglected only at the cost of a high mortality as well as a high morbidity, regardless of the surgeon's technical skill. In recent years important advances have been made in the preparation and after care of the patient. This presentation is a review and evaluation of these agencies. No reference will be made to diagnostic, operative, or anesthetic procedures unless they involve the patient's preoperative or postoperative treatment.

PREOPERATIVE PREPARATION

Evaluation and repletion. The preparation of a patient begins when it becomes apparent that he may be a candidate for operation. Any patient who has a malignant neoplasm or a chronic infection may be assumed to have an anemia. As a part of the history a few pertinent questions relative to dietary habits and food intake can aid in the estimation of depletion or subclinical deficiency. The obese person should be told that a a reduction in weight is necessary before an operation on the thorax can be undertaken with maximum safety. Considerations such as these may often be profitably applied to the period between the patient's first visit and his admission to the hospital days or weeks later. In short, the employment of iron, supplementary vitamins, and dietary instructions should be begun at once if there is any indication for their need.

In some diseases there is an optimum time for operation. The wise surgeon, for example, will rarely perform a major operation on a tuberculous patient who has not been under medical observation for at least 2 months. He will be careful to carry out resection for bronchiectasis during a remission, when pneumonitis and hilar adenopathy are likely to be at a minimum (9). Since the intrabronchial instillation of iodized oil occasionally produces a febrile reaction or possibly a lipoid pneumonia, it is well to postpone the operation for a few weeks after the making of a bronchogram (9).

From the work of Blalock, Ravdin (73,88), Elman, and others (91) it is now realized that much depends on the care with which a patient is prepared for operation. A patient who is fatigued or depleted, or who has long been at complete bed rest, tolerates surgery poorly. Not only may life be endangered through shock and a stormy convalescence, but the benefits of the operation are apt to be greatly curtailed if it must be hurriedly carried out or prematurely terminated. On admission to the hospital a precise evaluation of the patient's state of health is possible. At some time before operation sputum cultures for pyogenic organisms—and fungi, if their presence is suspected—should be carried out, since the character of the organisms present in the sputum may influence the choice of antibiotic, and perhaps even

From the Department of Surgery, University of Michigan, Ann Arbor, Michigan.

the procedure. Tuberculosis, for instance, may not be suspected, but a series of examinations of the sputum concentrate should be done routinely. From time to time the unexpected finding of acid fast bacilli clarifies a doubtful diagnosis or demonstrates that tuberculosis coexists with some other pulmonary lesion. This discovery, except in the presence of a neoplasm, would be very likely to affect the decision in regard to treatment. Whatever the etiology of the disease may be, if the patient raises sputum, its daily amount should be recorded, preferably in grams, for serial comparison.

In addition to routine blood and urine examinations, determination of the type and Rh factor of the blood must be done. Abbott (1,2) has emphasized the fact that the concentrations of the constituents of the blood show a surprising variability, which depends on the plasma volume. The proteins of the plasma roughly mirror the state of the other body proteins in the proportion of about 1 to 30 (36), but in states of chronic malnutrition (as in a patient with esophageal obstruction), when body proteins are diminished, the blood volume itself is often reduced (37)—perhaps in an attempt to retain a favorable concentration of plasma protein. A severe anemia may also be present, but due to the masking effect of a decreased plasma volume, the protein concentration, red cell count, hemoglobin, and hematocrit may all deceptively appear to be normal. A simple means of ascertaining plasma volume would doubtless become a great asset. Obviously, no single test is absolutely trustworthy when it is considered apart from others or without regard to the history and clinical appearance of the patient (1,2).

When the patient is admitted, he should be given a high protein, high carbohydrate diet. If depletion is severe, as it is apt to be in carcinoma of the esophagus, some days or weeks may be necessary to overcome it sufficiently to make operation reasonably safe. Varco has demonstrated that anyone who can take fluids orally can ingest more than 8,000 calories per day without discomfort (91). He feels that patients should be carefully prepared for from 5 to 7 days for each 10 per cent of body weight which they have lost. For those who are completely obstructed, intravenous feedings are advisable, although the intake of both glucose and protein hydrolysate may be limited by the amount of fluid which can be administered safely. In such cases the advisability of a jejunostomy or gastrostomy should be considered (85).

Not only the blood volume but the red cell mass has a relation to the early onset of surgical shock (37). A deficiency of the latter can be corrected only by transfusions of whole blood. Rapid correction of a severe or prolonged anemia may result in a feeling of security which is not justified. Not only has the circulatory system become accommodated to the decreased volume but the heart may have suffered some damage. To increase the blood volume rapidly imposes more work on the injured myocardium before it has had an opportunity to recuperate. Large transfusions given frequently are apt to produce pulmonary edema or cardiac failure. Small transfusions given every 1 to 3 days over a period of 2 to 3 weeks, if necessary, are probably safer. While it is possible, and sometimes necessary, to give a low titer type O blood to a patient of another type, it is obviously better to use only homologous blood. Rh negative blood may be given safely to Rh positive persons, but the reverse may not be undertaken without the risk of stimulating the production of an anti-Rh agglutinin in the blood of the recipient (68).

The need for adequate reserves of ascorbic acid for satisfactory wound healing is well known (51, 59, 62, 98, 97). The dehiscence of a wound following pulmonary resection, or the opening of a bronchial stump or an esophageal anastomosis is a catastrophe which may be fatal. The tissue, blood, and urine levels of ascorbic acid are disturbed by anesthesia (17) and operation. Injured tissue immediately demands large amounts of ascorbic acid (97) and, if the reserves are low, the remainder of the body is depleted in the absence of adequate intake. Lund (61) has found that a daily intake of 2 grams is necessary to maintain a relatively normal blood level in some extensively burned patients. In general, it is not necessary to carry out elaborate saturation tests. It is safe simply to assume that the average patient is deficient and to give him at least 1 gram (98) per day for several days before operation. With regard to the other vitamins, it has been recently suggested (59) that the severely ill surgical patient may need more of these substances than was previously supposed (51). Levinson *et al.* recommend, in addition to 1 gram of ascorbic acid, 50 milligrams of thiamin, 50 milligrams of riboflavin, and 500 milligrams of nicotinic acid daily for several days before and after operation.

The surgeon usually relies on the internist in doubtful cases to estimate the status of the heart and kidneys. In young persons, well compensated valvular lesions do not add greatly to the operative risk (38). Congestive failure, coronary disease, and syphilitic aortitis, however, create a considerable hazard to the performance of any opera-

tion (33). An elderly patient with a history suggesting coronary disease may tolerate the operative procedure of pneumonectomy, but he is more apt to develop coronary insufficiency in the first few postoperative days than is the patient with normal coronary arteries, especially if any degree of shock or anoxia should occur during the operation. The diagnosis of congenital cardiac lesions, the preparation for operation of the patient with constrictive pericarditis, and the management of cardiac and renal complications require the close co-operation of the internist. Digitalis, in the absence of congestive failure, is not only unnecessary but probably harmful (38). Patients in whom the cardiovascular tone is poor after months of complete bed rest tolerate major surgery better if they are allowed to sit and walk for from 5 to 20 minutes twice daily for at least a week before operation.

Respiratory function is of great importance in thoracic surgery. Vital capacity is still commonly measured preoperatively, but since it represents only one component of the ventilatory function and is subject to so many variables, it is useful only in the broadest sense (4). In young patients lobectomy is usually followed by little appreciable reduction of the respiratory reserve. Indeed, the disease itself is more dangerous than operation or the possible loss of a little respiratory reserve. In the older patient who has a bronchial or pulmonary neoplasm the prognosis is so poor if resection is not done that considerable leeway in the matter of functional risk should be assumed. A rough clinical estimate of respiratory function can be arrived at by the correlation of roentgenographic findings with the efficiency of diaphragm and rib movements, studied fluoroscopically. In the roentgenogram, evidence of pleural damage, widespread nodular lesions, and emphysema are of considerable significance. At the fluoroscopic examination, if the free excursion of the diaphragm is limited for any reason, there is undoubtedly a decrease in its ventilatory power and, consequently, in the respiratory function. The response of pulse and respirations to the performance of some simple task, such as climbing a flight of stairs, has great practical application but alone cannot, of course, be expected to gauge respiratory function.

Spirometric and bronchospirometric determinations, however, are often of great assistance in the detection of the degree of functional impairment produced by discrete nodular scars or other pulmonary infiltrations, emphysema, pleural adhesions, and previous collapse therapy (28). Recent observations by Levy, Seabury, and Hull indicate that there are often remarkable discrepancies between the respiratory function (ventilatory and respiratory components), as estimated from data on patients' records, and that revealed by laboratory determinations. They conclude: "Without bronchospirometric studies one cannot properly appraise the percentage distribution of pulmonary function even when the complete clinical picture, radiological data, and vital capacity are taken into consideration. Information, not otherwise obtainable, is gained with sufficient frequency to justify the expense, time, and risks entailed."

Prophylaxis. One of the more important aims of preoperative preparation is the elimination of sources of infection in the upper as well as the lower respiratory tract. The grosser aspects of oral sepsis should be remedied by a dentist before any intrathoracic operation. Major surgery of the paranasal sinuses, however, is of more lasting benefit if it is postponed until at least several months after the elimination of suppurative pulmonary disease (47, 76).

In any disease characterized by pulmonary suppuration postural drainage is a fundamental treatment, even when operation is not possible. It is essential for preoperative preparation, and, if the best results are to be obtained, it must be used thoroughly and frequently. Its effects may be greatly enhanced by one or more painstaking bronchoscopic aspirations. On the morning of operation tuberculous as well as nontuberculous patients should have a thorough postural drainage. The inhalation of steam is often a valuable adjunct to posture. Beecher feels that postural drainage should not be done within 2 hours of operation because the patient's continued coughing may hinder induction of anesthesia (15). Bronchoscopic aspiration is usually not done on the morning of operation. Nevertheless, this may be advisable if the effort required to raise large amounts of sputum is tiring to the patient or if, after postural drainage, his cough and respirations continue to sound moist.

In many patients with bronchiectasis the administration of penicillin produces marked change in the sputum. The bronchopulmonary secretions decrease in amount, become less purulent, and often lose their offensive odor. Occasionally, when gram positive cocci predominate, the sputum practically ceases after 4 or 5 days of penicillin therapy (68, 69, 81, 50). Penicillin alone has certain inadequacies: it has no significant effect on most gram negative bacilli and, with the disappearance of the cocci from the sputum, the bacilli appear or increase in number (50, 81). These organisms have been found to grow luxuri-

antly, maintaining the volume of the sputum and possibly even producing distant complications (81). In a preliminary report Olsen (69) has shown that the administration of streptomycin with penicillin as an aerosol can forestall this shift in bacterial flora by promptly eliminating the gram negative streptomycin sensitive organisms from the sputum, with resultant favorable changes in character and volume. In order to produce a satisfactory blood and tissue level of penicillin, it must be given intramuscularly, but topical application of this drug to the diseased bronchial tree has a more direct effect on the organisms established there. A combination of the two methods of administration of penicillin, together with streptomycin, should give an ideal temporary bacteriostatic effect. It has been suggested that penicillin be given routinely by both routes in dosages of 250,000 units per day intramuscularly, plus 200,000 units in 20 cubic centimeters of distilled water either as an aerosol or via intrabronchial catheter (7). We believe that a catheter may be preferable since it deposits the drug in the diseased portion of the bronchial tree where respiratory exchange is usually poor, rather than disseminating it throughout the healthy segments of the lungs. Because of the ability of many organisms rapidly to develop tolerance to streptomycin it is further suggested that this agent be withheld until 3 to 4 days before the planned date of operation, when it should be added to the penicillin solution which is being given by catheter, in 0.75 to 1.0 gram amounts daily (7).

While patients who have acute pulmonary abscess should be given adequate doses of penicillin, an undetermined percentage will show no significant response (13, 56, 74, 78, 83). Improvement is again probably related to the sensitivity of the bacterial population to the antibiotic used and, of course, to the presence of irreversible pathologic changes. As yet there has not been enough collective experience with antibiotic drugs to allow us clearly to formulate the indications, combinations with one another or with sulfonamides, and exact dosages. At any rate, the dosage of penicillin for lung abscess should probably be in the neighborhood of 500,000 units per day over a prolonged period (7).

Perhaps a few very early empyemas can be aborted with penicillin (3,74). Certainly it should be injected as an aid in controlling toxicity when an empyema space is aspirated in preparation for drainage, but only after identification of the causative organism. This may mean a delay of 2 or 3 days but it avoids the use of the drug for organisms which are not susceptible. Many empyemas are sterilized, at least temporarily, by relatively small amounts of the drug. As Blades (19,20) and others (74) have pointed out, this by no means constitutes a "cure." Delay in treating the mechanical problem by surgical drainage may leave the patient with latent infection or great functional damage.

It seems probable that streptomycin will be increasingly useful in the prevention and treatment of postoperative spreads in patients who undergo pulmonary resection for tuberculosis, or in whom there is an abundance of thin sputum containing many tubercle bacilli. The use of either penicillin or streptomycin occasionally produces an acute allergic manifestation. If the indication for the antibiotic agent is sufficiently urgent, the administration of one of the antihistamine drugs may permit a cautious resumption or desensitization after the acute reaction has subsided.

When a thoracoplasty is performed over a closed pleural space containing air or fluid, or both, a rapid increase in intrapleural pressure results (8, 9, 65). Highly positive pressure upon the heart and mediastinum produces a form of shock which may be rapidly fatal. Consequently, the pressure in such a closed space should be measured on the day before operation and adjusted until the inspiratory reading is approximately −20 centimeters of water, or to whatever figure barely causes the patient slight discomfort from the degree of negative pressure. Faintness, pallor, rapid pulse, and cough are danger signs, and aspiration should be terminated immediately should any of them appear. Even though the patient is left with a considerable degree of negative intrapleural pressure, the surgeon should be on the alert during the operation. If a rapid fall in blood pressure occurs, intrapleural pressure should be measured at once and air removed if necessary. A large tension cavity with a tightly blocked bronchus can produce the same effect (10).

A brief explanation of the nature of the disease and what the operation is expected to accomplish is often reassuring to the patient. If the advisability of early postoperative ambulation and the necessity for cough and breathing exercises are impressed upon him, his co-operation will be all the more freely given. Time is not wasted which is spent in explaining the significance of wheezes and audible bronchial moisture, and in supervising, on at least one occasion, the preoperative practice of cough and breathing exercises. When the patient's deficiencies have been ascertained and largely corrected, when the sputum has been rendered as scanty and innocuous as possible, and when the patient has been briefly instructed in the

necessity for such co-operation as he may be able to give postoperatively, he is ready for operation.

CARE OF THE PATIENT DURING OPERATION

The proper management of a surgical patient is the continuous application of functional principles; this is particularly important during the relatively brief period of the operation, when new and powerful factors are being introduced. The immediate preoperative routine need not differ from that generally used before any major operation under inhalation anesthesia. A mild sedative is usually given the night before operation and often repeated in the morning; except for this, nothing should be given by mouth after midnight. Reference has already been made to the preoperative evacuation of pulmonary secretions. Operations which can be performed under local anesthesia, e.g., minor procedures for tuberculosis or the drainage of empyema and lung abscess, require in addition only codeine or morphine as premedication. Either ether or cyclopropane, in closed circuit, is used successfully in thoracic surgery. Each has certain disadvantages which its proponents are inclined to minimize. More important considerations than the agent itself are: (1) a smooth induction (2) an adequate airway with a high proportion of oxygen in the mixture of anesthesia gases, (3) a moderately deep plane, with attention on the part of the anesthetist to dangerous reflexes which may be produced by the surgeon, and (4) the scrupulous cleansing of the tracheobronchial tree as soon as moisture is detected.

The use of an intratracheal tube is rarely necessary for thoracoplasty but a tube should be employed in any major intrathoracic operation when the patient is more than 10 years of age. At the University of Michigan Hospital it is seldom used in younger or undersized children because of their increased liability to laryngeal edema, although in some clinics tracheal intubation is practiced almost routinely in children of any age, for any thoracic operation. No rigid rule, however, can be adopted since circumstances may be such that the acceptance of the possibility of laryngeal edema and the performance of an immediate tracheotomy may be preferable to omission of the tube. The presence of such a tube affords the anesthetist complete control of the anesthesia and the respirations, even in the event of a bilateral pneumothorax; it prevents the interference of adducted vocal cords with respiratory exchange and gives ready access to potentially dangerous bronchopulmonary secretions. While an inflatable cuff makes the system absolutely gas tight, it has the disadvantage of being relatively difficult to insert and occasionally is responsible for serious and even fatal complications. If the proper size of Magill tube is chosen, the anesthetist will have little difficulty with leakage. The latter can be controlled, if necessary, by the use of a face mask over the patient's nose and mouth, and the open end of the intratracheal tube, or by a pharyngeal pack. In adults the tube is more easily inserted under local than under general anesthesia. The pharynx, larynx, and trachea are prepared as for bronchoscopy while the patient sits upright on the side of the table. The lubricated tube is then passed with the aid of a metal stylette and a laryngeal mirror, after which the patient is placed in the supine position and the tube is immediately connected with the machine and strapped in place with adhesive. The person who passes the tube should ascertain from its length how far it must be inserted so that the end will lie not less than 2 centimeters above the main carina, the position of which is marked externally by the second costal cartilage. Maier (65) warns against the use of too small a catheter for aspiration through the intratracheal tube. One that may be adequate for the removal of thin secretions may not be large enough to aspirate the thicker material expressed by the collapse or manipulation of diseased pulmonary tissue. A number 16 F. catheter with its end cut off squarely or obliquely should be adequate for use within a large Magill tube, but smaller sizes of the latter necessitate correspondingly smaller aspiration catheters. After the induction, the patient is placed in position and securely braced and strapped. If the thoracoplasty position is used, the dependent leg is flexed; the weight of the uppermost leg, which remains straight, can be supported by a pad so that it will not interfere with the flow of fluids into the opposite long saphenous vein at the ankle. A cannula or large needle is inserted into the saphenous vein and the administration of a solution of 5 per cent glucose begun at once. The peripheral veins may be so contracted in shock that fluids will not flow by gravity. Since it is usually necessary at such times to give blood rapidly in large amounts, a three way stopcock and a 20 or 50 cubic centimeter Luer syringe should be available to insert into this system. The table should be tipped until the patient is in a 15 degree Trendelenburg position.

It is of great importance for the surgeon and the anesthetist to understand one another's difficulties (65). On the one hand, the surgeon's impatience during induction, or his failure to pause should the plane of anesthesia become too shallow

for certain manipulations, is dangerous. On the other hand, the anesthetist's unfamiliarity with the mechanics and procedure of the operation, failure to keep the airway free of secretions, to prevent anoxia, and to discuss with the surgeon the patient's condition or details of blood loss and fluid replacement can be even more disastrous. At 20 or 30 minute intervals, at phases of the operation when temporary interruption is feasible, and only after aspiration if there is any hint of moisture, the pressure in the anesthesia system should be increased by the gradual application of positive pressure until the lungs are moderately inflated, the mediastinum thus being returned toward its normal position (15). This pressure should not exceed from 10 (65) to 15 (55) centimeters of water. If the system has no manometer, the anesthetist must be guided by instructions from the surgeon, who has the lung under his direct observation. Once the desired degree of moderate inflation is attained it should be very gradually released (15). Manual pressure on the breathing bag is usually not only unnecessary but inadvisable, since dangerously high intrabronchial pressures, the effects of which are well known, can be unintentionally produced (5).

Vagal reflexes can often be prevented or abolished by the injection of the vagus nerve with procaine solution or by dividing it below the origin of its recurrent laryngeal branch. Injection of the peribronchial tissues may prevent afferent impulses produced by manipulation in this region. Even though peribronchial injection may not be deemed necessary for this purpose (18), it produces no damage and may be of assistance as a mechanical aid to dissection by distending the tissues.

Distortion of the mediastinum, such as occurs when the lung or a mediastinal tumor is being pulled upon, is well known to produce lowering of the blood pressure by mechanical or reflex action (18). When this occurs, it is important to interrupt the traction temporarily. The motion of the diaphragm can be stilled by injection or crushing of the phrenic nerve. This has been objected to on the grounds that an active diaphragm is of importance in aiding the postoperative expansion of the upper lobe following lower lobe lobectomy (47, 55). Most surgeons believe that a temporary paralysis, produced by crushing the nerve at operation or within the first postoperative week, is desirable to assist in the obliteration of the space left by lower lobe lobectomy. Paralysis of the diaphragm during pneumonectomy may make the operation easier and reduce the volume of the space to be filled postoperatively; the paradoxical motion which ensues, however, transmits through the air or fluid of the closed space a pendulumlike movement to a labile mediastinum which might be harmful (53).

Except for the prevention of anoxia, no subject is of more immediate importance in the operative care of the patient than blood loss and its replacement. It is obvious that any consideration of blood loss is meaningless unless size (body weight) is taken into account (26). For example, a total loss of 200 cubic centimeters amounts to 4 or 5 per cent of the total blood volume of the average sized adult. This is relatively trivial, whereas, in a 40 pound child 200 cubic centimeters is 12.5 per cent of the blood volume. The aim should be to replace blood, volume for volume, as it is lost (26, 29, 80). It is also important during and immediately after pneumonectomy not to give more blood than has been lost (39), insofar as this can be determined. Dangerous strains on the body's homeostatic mechanism are thus mitigated, and convalescence will be shortened. White and Buxton (95) reported 1,607.5 cubic centimeters as the average blood loss for 10 lobectomies and 1,458.8 cubic centimeters for 6 pneumonectomies, while Baronofsky *et al.* found a total average of 1,399 cubic centimeters for 14 lobectomies and pneumonectomies. An extensive revision or Schede thoracoplasty can scarcely be performed without a loss of 1,000 cubic centimeters, and may involve much more. The surgeon thus has a foreknowledge of the average loss which he may incur; he should not embark on a major operation without the estimated amount being immediately available. If he proposes to remove a small, atelectatic lobe which has been the seat of bronchiectasis for some years and in which repeated attacks of pneumonitis may have produced dense adhesions, he can expect much greater than the average loss of blood. Since the largest loss usually occurs within the first hour and a half, blood should be started at or even before the time when the incision is made. In the event of unexpected, sudden, massive blood loss there is no contraindication to the rapid administration of blood with a syringe and three way stopcock interposed in the intravenous system until restoration of the approximate amount lost has been effected. The lives of many war casualties were undoubtedly saved by large amounts of blood and plasma given by this means.

The viscosity of whole blood may be decreased by dilution with a third, a half, or an equal volume of isotonic saline solution. There is, however, no need for the replacement of sodium, and it should be remembered that the administration of 2,000

cubic centimeters of blood mixed with the same amount of saline solution carries into the vascular system almost 30 grams of sodium chloride (82). It is especially important to dilute blood given to infants with as little saline solution as possible, since many become edematous when the operation precludes feeding for the first few days after operation. On the whole, in view of the fact that there is no need for the extra sodium, it is probably better not to use isotonic saline solution, even though it is the most satisfactory diluent for blood.

It is very difficult to estimate blood loss clinically. Indeed, shock may occur before the surgeon realizes the magnitude of the loss. Wangensteen (93, 14) has developed a simple gravimetric method by which blood loss is serially determined throughout the operation. Only dry gauze sponges or packs of standard weight are used to remove blood from the operative field. These are carefully collected as they are used and are weighed at frequent intervals on a balance accurate to 1 gram. Each gram gained by the sponges is assumed to represent 1 cubic centimeter of blood. Since the specific gravity of blood is greater than 1, the calculation is not strictly accurate but the error is negligible and is more than compensated for by the inclusion of fluids from serous membranes. In fact, the authors suggest the subtraction of 10 per cent to correct for such fluids. While this method is obviously not exact, it seems to be of considerable practical value in that it gives a better continuous estimate than has ever been available before. The operative field can be washed with cleansing or antiseptic fluids after the free blood and clots have been removed for weighing. Warm moist packs, with any blood they contain, are simply not weighed.

When that part of the operation associated with bleeding has been completed and the necessary blood has been given, a 5 per cent solution of glucose may then be given. This should not be allowed to flow rapidly, since the lowering of the plasma protein concentration which occurs when fluids are rapidly administered intravenously predisposes toward pulmonary edema by lowering the colloid osmotic pressure of the blood as well as by increasing the blood volume (40). This is particularly important during and after pneumonectomy, when the entire cardiac output must suddenly be forced through the vascular bed of the remaining lung. Altschule *et al.* have shown that the vital capacity and its components are slightly reduced (9.6 per cent), even in normal persons, by large infusions given intravenously at rates of more than 39 drops per minute. The pulmonary capillary bed is voluminous and can accommodate considerable overdistention at some cost to the intra-alveolar space. However, patients with pulmonary disease who are undergoing drastic reduction of pulmonary tissue by resection or collapse, under an inhalation anesthetic, should not be subjected to even the slightest avoidable increase in the distention of this elastic system. When its capacity is finally exceeded and the hydrostatic pressure in the pulmonary capillaries surpasses the colloid osmotic pressure of the plasma, pulmonary edema occurs suddenly. Cournand and Berry (27) state that the most important cause of early death following pneumonectomy is the failure of proper hemodynamic adjustment to take place. Strains produced by dilution of the blood and overfilling of the vascular system, caused either by rapidly given infusions or by gross overtransfusion within a short period (39), may prevent this adjustment. The slow intravenous flow of glucose solution may be allowed to continue for several hours after operation until a total of from 3,000 to 5,000 cubic centimeters of fluid, not including blood, has been given. As has been intimated, the use of isotonic saline solution, beyond the optional amount for dilution of blood, is inadvisable in view of the decreased postoperative excretion of sodium by the kidneys.

The usefulness of penicillin in the pleural space has been amply demonstrated (3, 74, 90, 94, 96). The ability of this drug occasionally to sterilize even an established empyema, which is caused by penicillin sensitive organisms, can no longer be doubted. Since pleural complications following open chest operations are, with few exceptions, due to gram positive cocci, there is considerable reason for, and none against, its routine use in large amounts whenever the pleura is opened. From 200,000 to 400,000 units in distilled water can be left in the pleural space or injected after the aspiration of the residual air through a catheter left in the wound for that purpose during its closure.

Most surgeons do not drain the pleural space after pneumonectomy, preferring rather to retain the fluid (which later becomes an organized exudate) as a space filling medium and to adjust the mediastinal position by thoracentesis. This also has the advantages of allowing high concentrations of penicillin and of avoiding the introduction of bacteria by way of a drain. After lobectomy early expansion of the remaining lobe to cover the hilum of the resected lobe and to obliterate the empty part of the pleural space as soon as possible is desired. Because of the danger of contamination and the obvious difficulties of thor-

acentesis most surgeons prefer to drain the space for at least 48 hours. A number 28 F. mushroom catheter from which the distal half of the mushroom has been trimmed away to leave a flange is conveniently placed through an intercostal stab wound one or two interspaces below the incision at the posterior axillary line. The catheter ends dependently with the usual water seal. It should be clamped near the chest for at least 4 hours after operation to avoid immediate loss of the penicillin solution. White (94) has suggested an ingenious modification of this standard drainage. An intercostal catheter is clamped and incorporated in the dressing. Each day the accumulated fluid is removed and penicillin injected through the tube, with aseptic technique. The catheter is withdrawn between the third and fifth days and further collections of fluid are removed by thoracentesis. Using this method he has had only 2 empyemas after 36 lobectomies, in both of which bronchial fistulas were also present. These occurred after extensive resection which left a large dead space that could not be obliterated because of the limiting adherence of the remaining pulmonary tissue.

Intrathoracic procedures which do not involve the esophagus or the lung are generally followed by closure without drainage. Fluid in varying amounts always accumulates after operation and is easily removed by thoracentesis. The pleural or extrapleural space should be kept as dry as possible. When a pneumonotomy is done for drainage of a tuberculous or other type of abscess, the cavity is snugly packed with narrow gauze which, although it is ultimately replaced by a large tube, need not be changed for the first 3 postoperative days.

The type of drainage required for empyema depends upon the size of the space and the mobility of the lung and mediastinum. It is safe to assume that most nontuberculous pleural abscesses need drainage by rib resection. A small, inelastic space may be handled safely by wide incision and gauze packing. Large spaces, however, should be drained by a large tube (½ inch inner diameter by ⅛ inch thickness of wall) of gum rubber. To be airtight the tube must fit snugly in the incision through the deep layer of the periosteum and parietal pleura. Vaselined gauze is usually packed between the tube and the extracostal muscles and the outer end of the tube is closed by a water seal. The tube is fixed in position by adhesive strips passed through a safety pin in its wall at the level of the skin. Johnson (54) has suggested an airtight dressing which is effective even over large openings when suction is to be applied. This consists essentially of a rubber glove from which the fingers have been cut off, and which is split along the ulnar side. The drainage tube is inserted through the tip of the thumb and the resulting large square, trimmed to appropriate size, is applied to the operative defect with waterproof adhesive, the thumb sheathing the tube externally. Water sealed drainage tubes, while not always necessary for safety in limiting the respiratory variations of intrathoracic pressure, encourage the expansion of the lung by the negative pressure created within the system by the dependent column of water. In addition, the tube provides a neat mechanism for removing irritating and malodorous exudates from the neighborhood of the wound.

The healing of a wound is related not only to the body protein (88, 73) and ascorbic acid reserves (97), but also to certain technical details which are too well recognized to need discussion. In the closure of an open chest, however, there are several points worthy of attention. Johnson (53) has suggested the crushing of several intercostal nerves near the spine, above and below the incision, to minimize postoperative pain. Except in its posterior portion, the wound should then be anesthetic. Annoying paresthesias and weakening of the upper abdominal muscles anterolaterally for several months after operation occur after crushing of 4 or 5 intercostal nerves, especially those below the seventh. The nerve corresponding to the incision and the ones immediately above and below it may with advantage be infiltrated with a solution of some local anesthetic just before closure of the wound. Although the effect of this anesthesia is likely to last less than 24 hours, external injections can be repeated at will during the immediate postoperative course.

The incision of the parietal pleura and periosteum, or intercostal muscles, can be closed with or without pericostal sutures. Since an intercostal closure is weaker than a closure utilizing periosteum, the former can be supplemented by 2 wire pericostal sutures placed around adjacent ribs beneath the periosteum (70). A careless closure of the deeper layers may occasionally be followed by massive subcutaneous emphysema (63). During the closure of the thoracic wall the lung or remaining pulmonary tissue should not be fully inflated lest it be torn by the needle. Expansion can be more safely obtained and the amount of air entrapped within the pleural cavity roughly regulated by the temporary inclusion in the wound of a catheter through which, after approximation of the extracostal muscles, the remaining air can be aspirated following lobectomy and the catheter

removed. In pneumonectomy, it is desirable only to prevent displacement of the mediastinum from a position near the midline. The pressure in the air filled hemithorax should be measured with a pneumothorax apparatus as soon as the patient can be safely placed on his back. If the inspiratory and expiratory pressures vary much from approximately -14 to 0 centimeters of water, they should be readjusted by aspiration or injection of the necessary amount of air.

The leveling of the table and movement of the patient onto his back or into his bed tend to redistribute the blood volume. This may temporarily simulate blood loss, and impending shock can be precipitated unless changes of position are effected very gradually (15).

The removal of the intratracheal tube should be preceded by thorough aspiration of secretions, first from the oropharyngeal and nasal cavities and then by means of a catheter in the intratracheal tube from the tracheobronchial tree. With few exceptions, however, bronchoscopic aspiration of the bronchial passages should also be done after pulmonary resection and after any operation when the respirations sound wet. Even after the most thorough preliminary aspiration by means of a catheter introduced through the intratracheal tube it is not uncommon to discover shortly afterward, on bronchoscopic visualization, secretions or clots in the lobar orifices of the dependent lung. The effect of such secretions is often demonstrable when films made directly after operation show surprisingly large areas of atelectasis in the lung of the nonoperated side. If bronchoscopic aspiration is to be done, the plane of anesthesia should be deepened somewhat before the intratracheal tube is removed, not only for ease in the introduction of the bronchoscope, but for safety (16). Death due to cardiac arrest has followed more than once the performance of bronchoscopy in a patient under light general anesthesia (70). Some authors even advocate the intravenous injection of 0.8 milligram of atropine sulfate (grains 1/75) from 10 to 15 minutes beforehand (16) as an added attraction.

A film of the chest made while the patient is still on the table is useful in showing the degree of inflation of the lung and the position of the mediastinum, as a check upon percussion and auscultatory findings. Should decostalization in any operation, for example an anterior thoracoplasty, have left an area of thoracic wall without bony support so that respiration or cough produces paradoxical motion, the dressing should include sufficient packing and should be applied with sufficient firmness to reduce such motion to a minimum, as well as to increase the desired collapse of the lung or pleural space.

CARE OF THE PATIENT AFTER OPERATION

The postoperative occurrence of anoxia is probably underestimated in thoracic patients because neither dyspnea nor cyanosis is a reliable indication of any but great oxygen want (66, 55). Oxygen should be used after thoracoplasty if the patient has a low respiratory reserve and, of course, if cyanosis, shock, or tachycardia is present; or if the patient exhibits other clinical evidence of anoxia such as headache, restlessness, or confusion. It should be administered to all patients who have had pulmonary resection. The patient who has had a pneumonectomy should be returned to his room breathing oxygen through the mask of the anesthesia machine.

Oxygen equipment should be ready for immediate use in the patient's room. A mask such as the Boothby-Lovelace-Bulbulian is rarely necessary and has some disadvantages. A nasal tube also possesses some drawbacks but is a relatively simple device which can be counted on to deliver up to 40 per cent oxygen in the inspired air. The irritating action of the tube can be minimized with an emollient and the dryness of the oxygen must be mitigated by passing it through water. Unnecessarily prolonged use of oxygen is to be avoided (55). It does not relieve all types of dyspnea; it thickens the bronchial secretions by its drying action; it can act as a respiratory irritant (55); and its administration may make adequate care and early mobilization of the patient difficult. The use of oxygen can usually be discontinued safely from 18 to 36 hours after lobectomy, but it should be kept at the bedside and used again in the event of any complication. An incompletely expanded lobe is somewhat like an atelectatic lobe; there is a discrepancy between ventilation and circulation, the mixed arterial blood having an oxygen saturation which is lower than normal. Some of the clinical signs of oxygen deficiency have already been mentioned but, according to Maier and Cournand (66), and others (55) the only completely reliable guide to the degree of oxygenation of the blood is the determination of arterial oxygen saturation. The continuance of oxygen therapy for as long as 48 hours, or more, is often advisable after pneumonectomy, because of the extensive adjustments needed to re-establish cardiopulmonary balance.

Oxygen is only rarely necessary following such intrathoracic operations as the removal of a mediastinal tumor when the patient has no pulmonary disease, provided that operative shock

did not occur and the lung was completely expanded at the end of the operation. Such a patient does not need the Trendelenburg position, as a rule. For unconscious patients, however, who have undergone a long major operation the Trendelenburg position has several advantages. Venous return is encouraged and bronchopulmonary and pharyngeal secretions, as well as vomitus, drain toward the mouth. In addition to having the bed inclined from 10 to 15 degrees, patients who have had a thoracoplasty or intrathoracic operation should be placed on the side which was operated upon and should spend most of their time there, except for the periodic changes in position already discussed.

It is essential that a competent nurse be at or near the bedside for the first few postoperative hours. The blood pressure and pulse must be followed closely and the pharynx aspirated when necessary. As soon as the patient is conscious he should be instructed to cough. Manual support in the region of the wound is of great assistance to him at this time. When the blood pressure has become stabilized at a normal level and the patient is fully awake, he is more comfortable lying flat than with his head down. For aid in raising his sputum he may be assisted to a sitting position for a few moments, since patients often seem better able to "reach" their secretions when they are sitting erect than when they are recumbent. The importance of keeping the tracheobronchial tree free of secretions cannot be overemphasized. While the patient should spend most of his time on the side of the operation, at hourly intervals he should be turned on his good side and told to cough, even though his respirations may sound dry. The slightest evidence of bronchial moisture is the signal for an attempt to evacuate the offending secretions.

Carbon dioxide is a liquefying agent which reaches the smaller bronchioles and is of great value in loosening secretions there, both by its solvent action and by the hyperventilation it induces. The iodide expectorants and steam apparently produce an increase in the output of respiratory tract fluid (23), but this is said to be largely from the major bronchi rather than from the finer ramifications where the secretions are viscid (48). Holinger recommends the addition of steam whenever oxygen is used in order to counteract its drying, "antiexpectorant" effect on the respiratory mucosa (48). A constant temperature bath for oxygen humidifiers would be of considerable advantage if it were available. Certainly, of the common expectorants, carbon dioxide and steam are the most useful; the former should always be used to the point of moderate hyperventilation before the patient coughs, at intervals of not more than 2 hours the first few days after operation.

A considerable proportion of the constant and meticulous postoperative care of the patient must be carried out by the surgical staff. If it is found, for instance, that pain makes the patient lie still, with a splinted hemithorax and a suppressed cough (24), moderate doses of a narcotic may enable him to extract the maximum efficiency from his cough by dulling its acute painfulness. Since all narcotics depress respiration to some degree, they must be used with caution. Morphine sulfate in doses of from 8 or 10 milligrams at 3-hour intervals is better than larger doses at 4 to 6 hour periods. If the patient has a marked decrease of respiratory function, demerol or codeine should be employed rather than morphine, for routine relief of pain. The injection of several intercostal nerves posteriorly, above and below the incision, with a local anesthetic solution may afford striking relief for an indefinite period and can be repeated when necessary (24). If the sequence of pain-spasm-cough suppression is not broken, a postoperative "wet lung syndrome" is likely to develop.

There are other factors besides pain which prevent the effective raising of secretions. Pulmonary emphysema, a paralyzed hemidiaphragm, a large drainage tube, partial obstruction of any part of the lower respiratory tract, bronchopleural or bronchocutaneous fistula—all may help rob the cough of its effective propulsive power. If the remaining lobe on the side of the lobectomy contains residual bronchiectatic tissue, the difficulties of keeping its bronchial system free of secretions are further accentuated. Such a lobe is, as Maier (64) has pointed out, more likely to develop atelectasis than is one which has no bronchiectasis. Temporary clamping of a drainage tube, especially if it is large, adds greatly to the force of a cough. If the patient is unable to raise his secretions, or if he is unwilling to try, catheter aspiration of the tracheobronchial tree should be done (45) and repeated as often as secretions reaccumulate. It is rarely impossible to pass a catheter through the nose into the trachea; but even though it can be done with ease, if there is any doubt as to the complete removal of secretions or if some complication such as atelectasis should develop, it is better to examine the tracheobronchial tree bronchoscopically and aspirate under direct vision. This can be performed with surprising ease, without moving the patient from his bed, after brief anesthesia of the pharynx and larynx.

A brief physical examination of the chest can provide information which is often indispensable

and should never be neglected. It must be performed at least once daily, however, to have much significance. Rales, rhonchi, clicks, and wheezes are best heard during and immediately after coughing. It is often possible to determine quickly the position of the mediastinum, the presence of a pneumothorax or consolidation, or the presence or absence of breath sounds or pleural fluid.

The parenteral administration of fluid is seldom important in the thoracic patient after the first 12 to 24 hours, since most patients are able to take fluids orally. A full diet should be resumed as soon as possible. In the average adult who has no renal disease the route of administration and the exact amount of fluid given are of less importance than the maintenance of a minimal, daily urinary volume of 1,200 to 1,500 cubic centimeters. Diseased kidneys may require a much larger urinary output to carry off the products of metabolism, and the range of sodium adjustment is apt to be considerably narrowed. If the sodium intake is rigidly curtailed, fluid in large quantities can usually be given orally without danger.

An operation on the esophagus may occasionally require that nothing be taken by mouth for as long as a week. It is essential in such a case to furnish by the intravenous route not only enough fluid to produce a satisfactory urinary volume, but to supply at least 200 grams of glucose daily and as much nitrogen in an assimilable form as possible. Cutting and Cutter have shown that in normal subjects the lapse of only 48 hours without food can produce a lowering of the total circulating plasma protein from 170.7 grams to 156.5 grams (8.3 per cent), even though the concentration may remain unchanged. In addition, extensive surgical procedures themselves cause a negative nitrogen balance which may last many days.

It is difficult to realize the overwhelming burden which can be placed for a few days postoperatively upon the body's protein economy by the combined effects of chronic disease, incomplete repletion before operation, and operative blood loss. To these are often added the results of days of partial starvation and the variable loss of fluid containing both protein and red cells into the pleural space. Unless these effects are partially counteracted, convalescence will be hazardous and prolonged. Elman recommends that not a single day be allowed to pass without furnishing glucose, with nitrogen in the form of protein hydrolysate. This is a more efficient and economic way of furnishing the raw materials for protein synthesis than the use of plasma. Two liters per day of 5 per cent amigen in 10 per cent glucose solution furnish 100 grams of amino acids, 200 grams of glucose, and 5 grams of sodium chloride. Elman stresses the fact that amigen should be handled and given with more care than is customarily accorded to intravenous solutions, since it is an ideal culture medium for the growth of bacteria. Even when it is given at speeds of less than 500 cubic centimeters per hour, unpleasant reactions may occur unpredictably. One of the offending components is probably glutamic acid (79). The occurrence of any suggestive allergic reaction is regarded as a contraindication to the further use of the protein hydrolysate (36).

The fluid which accumulates in the pleural or wound space postoperatively, or which is carried off by a drainage tube or by thoracentesis, is only slightly less rich in protein, and often in red cells, than is the blood itself (6). Its loss differs from hemorrhage only in that it occurs over a period of days rather than hours (89). Indeed, it is a sort of slow plasmapheresis with the additional loss of red cells. Since this drainage takes place slowly, the body with its various restorative mechanisms is usually able to adjust itself to the loss. But poor wound healing, weakness, and greater liability to infection are likely to occur if it goes unrepaired (52, 99). The total average loss of bloody serum in Thornton's series of 12 consecutive lobectomies was found to be 673.3 cubic centimeters. The hemoglobin content of such fluid may be as high as from 6 to 8 grams per cent (87). The concentration of the plasma proteins fell 1 gram per cent between the third and fifth postoperative days (89), with similar decreases in the hematocrit value, hemoglobin level, and red cell count. Thomas, Adams, and Thornton studied 19 patients who had had major thoracic operations. The average postoperative lowering of hemoglobin was 2.1 grams per cent, most of which occurred between the third and seventh days. The normal person who suffers an experimental loss of from 15 to 20 per cent of his blood volume, restores his plasma protein concentration to a normal figure within 72 hours because he has adequate reserves of body protein (34). In these 19 patients, however, the plasma proteins returned to the preoperative level only after 9 days. At the end of from 7 to 12 days postoperatively the red cell volume was still less than the preoperative value by from 208 to 914 cubic centimeters. The obvious answer to such insidious blood loss is transfusion, controlled by accurate determinations of red cells, hemoglobin, and hematocrit (87), at 2 day intervals for the first 6 or 8 days after operation.

The status of the lungs, mediastinum, and pleural and extrapleural spaces can be followed accurately only by films or by fluoroscopy. If a

film is not made at the conclusion of such operations as lobectomy and pneumonectomy, while the patient is still on the table, it must be obtained at the bedside on the day of operation. A conscious patient with a stable blood pressure should be supported in a sitting position so that a pleural fluid level, if fluid and air are present simultaneously, will be visible on the film. Subsequent examinations, which should be carried out at intervals suitable to the case, may be done fluoroscopically and with occasional films. When gastric distention is present, especially immediately after operation, a Wangensteen suction apparatus results in prompt relief. Gastric aspiration is a necessary measure for several days following vagotomy because the stomach may become enormously enlarged if it is not drained. For patients who have had an intrapleural or extrapleural pneumonolysis, fluoroscopic control is essential on the day of operation and daily for at least the first few subsequent days. An intrapleural or extrapleural pneumothorax may be lost by the escape of air into the tissues of the thoracic wall within a few hours if air is not injected when it is needed. Following pneumonectomy the mediastinum should be maintained in the midline. An acute overdistention of the remaining lung has occasionally resulted from the use of a water sealed drain (63, 77). This is associated with serious lowering of the arterial oxygen saturation. Shift of the mediastinum in the other direction reduces the volume of the remaining lung and prevents adequate ventilation with the same end result, i.e., lowering of the arterial oxygen saturation. Mediastinal displacement in either direction may cause serious cardiovascular and respiratory disturbances (63, 12, 30).

For the first 5 to 7 days after pneumonectomy at least 100,000 units of penicillin should be placed in the pleural cavity daily. If the patient is lying supine, the needle may be conveniently placed in the second or third intercostal space at the midclavicular line. The intrapleural pressure should be measured at this time, before penicillin is introduced, by the use of a 3 way stopcock and a water manometer. The mediastinal position can then be adjusted if necessary, according to the pressure readings and the fluoroscopic findings, by the withdrawal of air or fluid or the addition of air. When aspiration is required, it is preferable to remove air because the fluid is a more permanent space occupying medium. Although it is desirable for the entire hemithorax gradually to fill with fluid, the hydrostatic effect of the dependent fluid collection may be dangerous to patients with a narrow cardiocirculatory margin, who can withstand little mediastinal displacement (58). Such hydrostatic pressure can be corrected, of course, only by the aspiration of several hundred cubic centimeters of fluid. Adjustments of this nature should be done slowly and terminated promptly if the patient experiences a pulling sensation within the chest, faintness, an increase in the pulse rate, or a desire to cough. Aspirated fluids should be cultured for pyogenic organisms on at least one occasion. If an extensive thoracoplasty has preceded the pneumonectomy, which is occasionally the case when the resection was done for tuberculosis, the problem of the residual pleural space is largely solved. The postoperative fluid is not needed, indeed is not wanted, in the relatively narrow pleural cavity since small accumulations of fluid may produce pressure upon the mediastinal organs. Needling of this slender cleft is more difficult and dangerous than ordinary thoracentesis. For this reason an airtight, water sealed drain should be employed for several days, or until the small pleural cavity is obliterated. Such a drain should be clamped near the dressing for several hours postoperatively to retain penicillin in the pleural cavity. When a pneumonectomy is done without a previous thoracoplasty, the empty hemithorax becomes partially filled with fluid which undergoes some organization. Resorption of pleural fluid and contraction of new connective tissue gradually cause a decrease in the size of the pleural cavity, with traction displacement of the mediastinum and consequent overdistention of the remaining lung. A year after operation one often finds that the lung has finally come to occupy far more space than it did preoperatively. On rare occasions it may apparently fill the major portion of the entire thoracic cavity. It is true that these changes occur gradually and may not be incompatible with a long life. But pulmonary overdistention or "emphysema" reduces the respiratory function (27) and puts an added burden on the right side of the heart. A further consideration is the effect of stretching upon tuberculous lesions if any should be present in the remaining lung. The patient's comfort and usefulness are thereby compromised and his ultimate life expectancy is unquestionably decreased. Since there is, at present, no satisfactory substance for introduction into the pleural cavity which will prevent this progressive undesirable change, the only alternative is the performance of early thoracoplasty. The extent to which the changes associated with chronic overdistention are reversible is not known. Once they have developed, thoracoplasty sometimes relieves dyspnea (27); but by this time the patient presents a

poorer operative risk. Overholt routinely does a thoracoplasty 6 weeks after resection of the lung or upper lobe for tuberculosis. Johnson advises thoracoplasty "following pneumonectomy in non-malignant disease, especially in young people with long lives ahead of them" (55). It is indeed difficult to advise a patient who has recently had a pneumonectomy for a malignant neoplasm that this operation requires at least two others. No surgeon would do so if he believed recurrence likely. But should the advantages of a thoracoplasty be denied to a man no older than 50 years of age whose neoplasm was small and apparently limited to the lung? It is a complicated question and further consideration of it is beyond the scope of this review.

From 4 to 6 hours after lobectomy gentle suction of from 10 to 15 centimeters of water should be applied continuously to the drainage tube. The remaining lobe will sooner or later fill the cavity and cover the inner opening of the tube. In order to determine when this occurs the tube should be temporarily clamped once each day, disconnected from the source of suction, and attached to a glass tube in a water sealed bottle. If respiratory oscillations have ceased and cannot be restored by adjustment of the tube at the thoracic wall or by the introduction of a little sterile saline solution with a syringe, the tube should be removed since it is serving no useful purpose. Loculated air and further accumulations of fluid can be aspirated by thoracentesis at frequent intervals, at sites properly selected fluoroscopically, until the space is obliterated. The persistence of a residual space for more than 10 days in the absence of atelectasis of the remaining lobe or of a bronchopleural fistula is unusual.

At the end of the first week after drainage of a postpneumonic empyema the space can usually be encouraged to obliterate faster if continuous suction is applied through the tube. Negative pressure as low as 150 centimeters of water (11 centimeters of mercury) has been used without demonstrable harm (54). If pressure of more than 20 centimeters of water is employed, it should be increased gradually over a period of several days to avoid causing the patient pain. The capacity of the cavity should be measured with saline solutions at intervals of not more than a week, provided that no bronchial fistula is present. Serial Potter-Bucky films in various projections, after injection of iodized oil into the cavity through the tube at weekly intervals, show progressive changes in shape and decrease in size of the empyema space. When it has reached a capacity of from 30 to 50 cubic centimeters, closed drainage is converted to open drainage by cutting off the tube near the skin. The remaining tube is exchanged for a smaller one which is shortened progressively over the course of weeks only as the walls of the shrinking cavity close around it and behind it. The successful treatment of a complicated or chronic empyema is often much more difficult than the simple outline given here would indicate. Various supplementary operations (alone or in combination) such as revision of drainage, extrapleural thoracoplasty, decortication, and Schede thoracoplasty may become necessary.

Physiotherapy should begin on the day of operation. All major posterolateral incisions compromise to some degree the large muscles which have to do with motion of the arm and shoulder. Early motion is necessary to prevent spasm, adhesions, and atrophy of muscle and bone. Passive motion of the upper arm in a circular manner while it is elevated as high as the patient can tolerate without actual pain should be done daily during the first postoperative week. As early as the first day patients should be encouraged to help themselves by reaching and turning, with the aid of the arm on the side of operation. By the third day, free, active motion is usually possible to the same extent as that of the good arm. It is particularly important for the patient to carry out his exercises assiduously after each stage of a thoracoplasty, when neglect would allow the scapula to become tightly bound to the altered thoracic cage.

The gratifying decrease in the incidence of postoperative complications and of discomforts of convalescence which accrues from early ambulation is now too well recognized to need special emphasis here (22, 25, 32, 57, 72). These benefits are not, however, nearly as striking if early rising is postponed until the third or fourth day. At frequent intervals during the first 24 hours the patient must be made to turn from back to side and encouraged to move his legs. In addition to certain commonly accepted contraindications to early ambulation (recent coronary occlusion, danger of hemorrhage, thrombophlebitis) the presence of lowered arterial oxygen saturation, dyspnea, or severe weakness, as well as operations on the pericardium, heart, and great vessels make recumbency advisable for more than the usual length of time. With these exceptions the patient who has had an intrathoracic operation can usually sit on the side of his bed, or even in a chair beside it, for two 10 minute periods during the first or second day following operation. Drainage and oxygen tubes are inconvenient but they do not prevent mobilization. Even though the patient

is weak or reluctant to rise, he is usually gratified by the rapid return of strength and appetite. Barring complications, the nontuberculous patient is able to walk freely about his room and probably to go to the toilet in less than a week.

Physiotherapy should by no means be confined to the restoration of function to the arm and shoulder after thoracoplasty or thoracotomy. The entire chest must be rehabilitated in order to prevent splinting due to pain and contracting pleural scar (46). Whether, after lobectomy, the remaining lobe on the side of operation ever quite regains its preoperative function is problematical. If the thoracic cage retracts and its muscular movements are impaired, lobar ventilation and gaseous exchange are certainly correspondingly reduced. A lobe so handicapped remains, in a relative sense, a space filler rather than a significant functional portion of important and irreplaceable tissue. If the disproportion between its circulation and ventilation is great enough, it might even become a detriment. When a physiotherapist familiar with postoperative thoracic problems is not available for preoperative instruction and the institution of exercises immediately after operation, these duties must be carried out by the surgical staff. Exercises to promote motion of the affected hemithorax are not difficult to devise. Harken (46) suggests that the first step is to make the patient aware of his immobile chest. For this he must be placed straight in bed with the head, chest and hips aligned. The therapist's hand on the lower thoracic wall is watched by the patient. Faint respiratory motions are exaggerated by the constant, firm pressure of the instructor's hand. At the end of expiration an added thrust is given with the hand after which this support is quickly released, and the patient should attempt to exaggerate the recoil. He gradually becomes conscious of the area and of its more or less faint respiratory motion and should continue his attempts, with assistance and in a methodical manner, to increase its motion. During the recent war both British and American thoracic centers carried a program of rehabilitation to a degree which should be the envy of civilian surgeons (35, 44, 46, 49). To graded bending, twisting, and stretching exercises were later added swimming and cross-country running. The patients' progress was graphically demonstrated to them by progressive increase in the measurement of their chest expansion and vital capacity, and in their increasing strength and endurance (35). Similar results would be difficult to duplicate outside a disciplined organization where patients can be supervised for weeks. Nevertheless, it is a part of the surgeon's responsibility to use every care to avoid leaving his patient with a surgically imposed, remediable handicap.

COMPLICATIONS

It is difficult to separate the combination of interrelated factors which determine a smooth or stormy postoperative course. Attention to many of the details discussed will often avert accidents that may take place after operation. There are, however, certain important complications which occur with sufficient regularity as to merit separate consideration as clinical entities.

Atelectasis. After lobectomy for suppurative disease, atelectasis of the remaining lobe on the side of operation is one of the most frequent and troublesome possibilities. The reported incidence varies from 10 per cent (64) to 33 per cent (41). It occurs almost 2½ times more often on the left side than on the right (41) and is far commoner in the upper lobe after lower lobe lobectomy than in the lower lobe after upper lobe lobectomy (64). Sampson and Collis have found that it occurs in women and men in a ratio of 5 to 2; Gray (43) has stated that it is twice as frequent in children as in adults. The incidence seems to increase after the resection of more than one lobe (75). The chief etiologic factor is the retention of secretions in the lobar bronchial tree. Important factors which contribute to retention of secretions are inadequate coughing due, in part, to pain, a paradoxical diaphragm and mobile mediastinum, a bronchopleural fistula, or the presence of a large drainage tube. Often turning the patient on his good side and having him cough vigorously produces a striking return of previously absent breath sounds. The full blown syndrome is frequently averted in this way. While atelectasis may occur during or immediately after operation, the remaining lobe usually appears in the roentgenograms to be satisfactorily aerated during the first 24 to 48 hours. Then, between the second and fifth days (42), when a splinted thoracic wall compromises lobar ventilation and drainage, the breath sounds over the upper chest anteriorly are found to be suppressed and the roentgenogram reveals a shrunken, opaque lobe. Unless secondary suppuration occurs the symptoms are relatively mild. The temperature and pulse may be somewhat elevated; cyanosis is occasionally apparent but, as a rule, the patient notices little subjective change except possibly mild dyspnea. Atelectasis usually clears within a week if it is promptly and energetically treated. If may, however, persist for many weeks. None of Maier's 8 cases remained permanently atelectatic the longest interval between collapse

and re-expansion was 6 weeks (64). Of 51 patients with atelectasis following the 154 lobectomies reported by Gowar, 14 had a permanent collapse and 9 of these died. The longer the lobe remains atelectatic the more certain is the advent of an extensive empyema. The intrapulmonary infection which follows unrelieved atelectasis often gains access to the large pleural dead space which remains as long as the lobe is unexpanded. Moreover, atelectasis is apparently a frequent primary stage in the development or extension of bronchiectasis. A lobe which was bronchographically normal before operation occasionally develops bronchiectasis after prolonged postoperative atelectasis (75, 42).

The most effective preventives of atelectasis are the continued stimulation of the patient to cough, the control of pain, the use of carbon dioxide and steam, and, when needed, intrabronchial catheter suction or bronchoscopy, or both. Efforts must be redoubled when atelectasis is suspected, without fear of "worrying" the patient. Since the effect of the continued perfusion of an airless lobe by its share of blood through the pulmonary artery is to reduce the oxygen saturation of blood returned to the left side of the heart, oxygen administration should be continued or resumed (66). If the cough is moist and unproductive, or if it does not rid the patient of moist sounds, tracheobronchial suction by catheter should be used freely; if this fails promptly to relieve the situation, bronchoscopic aspiration should be performed, repeatedly if necessary. On bronchoscopic examination there is usually no classical "mucous plug." The lobar orifice may be found bubbling with mucopurulent secretions, or the obstruction may be distributed in the finer air passages deep within the lobe. The coughing produced by an intrabronchial catheter or bronchoscopic aspirator is usually very helpful in loosening viscid secretions.

Empyema. This is unlikely to follow intrathoracic operations unless: (1) the pleura is heavily contaminated during operation from infected lung or other intrathoracic structures; (2) intrapulmonary complications occur in the presence of a dead space; or (3) bronchopleural fistula or separation of the thoracotomy wound takes place. When a bronchial fistula occurs in the presence of a large collection of intrapleural fluid, as following a pneumonectomy, drainage of the pleural space should be done as soon as the fistula is detected. Even if fluid under pressure were not aspirated into the lungs, a change in the patient's position could inundate the remaining lung. The opening of a bronchus is almost always followed by an empyema. In the absence of a fistula an early empyema can sometimes be aborted by frequent aspirations and injections of large amounts of penicillin. After lobectomy, the management of an empyema, once it is established, does not differ from that of any postpneumonic empyema. After pneumonectomy, the empyema space can be obliterated only by an extensive thoracoplasty. When an empyema occurs after pulmonary resection in which cotton tape was used for the ligation of hilar vessels, the tape is very apt to remain as a foreign body and maintain a small but persistently draining pleurocutaneous sinus until it is removed.

Spread of infection. Postoperative spread of pulmonary infections may follow the spilling of infectious bronchial secretions into undiseased pulmonary tissue. In resection for bronchiectasis this may produce a pneumonic process, although it is often difficult to distinguish such a pneumonitis from localized atelectasis. In any case it usually clears promptly with the aid of penicillin therapy. A more grave and indolent spread of infection is occasionally seen following drainage of, or resection for, lung abscess. Beyond the use of the antibiotics in combination with a sulfonamide there is no specific therapy for these infections. In tuberculosis, it may be impossible to distinguish a bronchogenic spread from a reactivation of latent lesions. Such fresh lesions are not uncommon after the performance of lobectomy and pneumonectomy for active tuberculosis (70, 86, 84), and occasionally they occur after thoracoplasty (8), especially when the lesion collapsed by operation was fairly fresh and of a caseous pneumonic type. The presence of an active tuberculous bronchitis at the time of any operation increases the likelihood of spread. It is hoped that the use of streptomycin in selected cases before and after the operation will offer some specific protection. If a serious spread appears after any operation for pulmonary tuberculosis, this drug appears to be indicated. Further surgery should not be carried out until the new lesions disappear or have been relatively stable for at least several months.

The management of many miscellaneous complications that occasionally arise after thoracic operations, such as wound infection, wound disruption, pericarditis, and thrombophlebitis, does not differ from their management under other circumstances and therefore will not be discussed here.

SUMMARY

The occurrence of complications and death after thoracic operations is surprisingly influenced by

the extent to which many details of preoperative and postoperative management are carried out. Of particular importance is the rapid restoration of the normal anatomical position of the heart and lungs and the maintenance of an efficient coughing mechanism.

The use of antibiotics, fluid and blood replacement, oxygen administration, evacuation of bronchial secretions, pleural drainage, regulation of mediastinal position, early mobilization, rehabilitation, and the prevention and treatment of a few of the common complications have been briefly discussed.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

The Lamina Cribrosa and Its Nature. MARIAN WILCZEK. *Brit. J. Ophth.*, 1947, 31: 551.

The author discusses our knowledge of the nature of the lamina cribrosa. This structure which has been likened to a membrane of India rubber is generally accepted to be a semi-independent scleral structure of which the dimensions are known. Its planes, thickness, and backward curve have all been measured.

To understand the structure of the cribriform lamina it is necessary to know its relation to the sclera and septa of the optic nerve. The cribriform lamina develops comparatively late, as late as the end of fetal life or even the beginning of extrauterine life. Trabeculae of connective tissue grow into the nerve and disk from all directions from the pia mater, from the sclera in the scleral canal, and from connective tissue which accompanies the central vessels.

Wilczek introduces the concept of the "nest" of the optic disk. Bundles of nerve fibres are separated by neuroglial tissue. Connective cells grow into these neuroglial septa to supply the nerve with vessels. Connective tissue divides the nerve into smaller and smaller bundles, and forms first, second and third grade septa, but still smaller septa are formed by neuroglia. There is no sharp division between the pia or dura mater and the sclera as meningeal sheaths pass into and coalesce with the sclera.

One of the most important functions of the cribriform lamina is considered to be fixation of the optic nerve in the scleral canal, where the optic nerve is exposed to the danger of being pulled. The cribriform lamina should not be considered as an independent structure but as the foremost and strongest part of the septal system of connective tissue of the nerve. JOSHUA ZUCKERMAN, M.D.

EYE

Ocular Injuries in Soldiers. BENJAMIN RONES and HELENOR CAMPBELL WILDER. *Am. J. Ophth.*, 1947, 30: 1143.

Of approximately 4,000 eyes enucleated in army hospitals between Pearl Harbor and V-J Day, 104 were removed because of nonperforating ocular injuries, 47 occurring during combat or training, and 57 occurring before the patient entered the services.

The interval between injury incurred during combat or training and enucleation varied from less than 1 day to 2½ years. The eyes enucleated on the day of injury had fresh hemorrhage as the dominant finding. As the time interval between the date of injury and enucleation lengthened, organization of the hemorrhage became more apparent, the incidence of chronic inflammation and secondary glaucoma increased, and atrophic changes took place. Later, pupillary and cyclitic membranes, calcium deposits in the lens, and phthisis bulbi were observed. Concussion cataracts, dislocated lenses, detachment of the retina and choroid, and evulsion of the optic nerve were present in many eyes.

In the cases of the 57 eyes that had been injured before induction, the interval between injury and enucleation was from 4 to 28 years. Chronic endophthalmitis was the most frequent finding in this group, with cataract, detachment of the retina and choroid, and secondary glaucoma following in that order. A great variety of degenerative and late inflammatory changes were recorded. The eyes with an endophthalmitis due to tissue trauma and subsequent hemorrhage but in which the condition was not complicated by surgery or secondary infection had a paucity of cellular response in contrast to the cellularity of infectious uveitis with lymphocytes and plasma cells as the dominant cell types. The exudative response was marked and resulted in the formation of synechiae and pupillary and cyclitic membranes. ROGER H. JOHNSON, M.D.

Angioid Streaks. BERTHA A. KLIEN. *Am. J. Ophth.*, 1947, 30: 955.

Five clinical cases of angioid streaks are recorded, with an additional clinical case in which there was a later histopathological study following enucleation of both eyes after death of the patient from arachnoiditis with severe cerebral hemorrhages.

Previous histological findings recorded by Boeck and Hagedoorn were confirmed, and some new observations made. As previously noted, the diffuse degeneration of the elastic portion of Bruch's membrane leading to ruptures and dehiscences may be sufficient to render the membrane opaque. Also observed, as in the 2 previously reported histological studies, was a coexisting vascular disease affecting chiefly the posterior ciliary and choroidal vessels. The positive iron stain of the lamina basalis in the posterior polar region, previously mentioned, was also found in these eyes.

A study of the morphological characteristics of the eyes in the present report showed that the earliest ruptures were limited to the elastic portion of the membrane, with the cuticular layer, the pigment epithelium, and the overlying retina remaining intact. There were two types of defects: (1) abrupt vertical severance and (2) oblique dehiscences, influenced in character perhaps by the previous calcification or degeneration of the elastic tissue. A positive Kossa stain demonstrated the calcification,

which appeared as spotty as the elastic degeneration shown by the orcein stain. In some places the edges of the breaks extended into the deeper layers of the choroid. Separation of the pigment epithelium occurred as a result of a cuticular substance produced by the epithelium, and extravasation from the choriocapillaris, or by a mixture of glial and fibrous tissue with capillaries derived from the pigment epithelium and the choroid, respectively.

Correlation of the clinical and histological findings is discussed in some detail. It is believed that the pathogenesis of angioid streaks is based upon an abnormal fragility and opacification of the lamina basalis of the choroid. Variations in intraocular pressure or slight pressure in the eyeball in such cases may cause the breaks, which are visible because of the loss of translucency of the membrane. The frequent association with pseudoxanthoma elasticum (not present in this case) suggests a primary inferiority of the elastic tissue in the body. Deposition of calcium into the membrane seems to be essential to all except the earliest manifestations of the disease. WILLIAM A. MANN, M.D.

The Effect of Aluminum and Its Alloys on the Eye: A Report Presented to the Vision Committee of the Medical Research Council. L. H. SAVIN. *Brit. J. Ophth.*, 1947, 31: 449.

The author reports a case in which a piece of "aluminum zinc" was observed over a period of 3 years as it lay on the retina of an only eye in a young British sergeant. At first the metallic object was bright and silvery, but later it presented a white coating which was believed to be aluminum hydroxide. After shifting twice and leaving a retinal "imprint" each time, it eventually disintegrated into a white powder.

Another case acted in a similar manner.

The experimental introduction of fragments of aluminum and aluminum alloys, ranging in size from 0.3 to 20 mgm., into the anterior and vitreous chambers of rabbits revealed that there was no clinical difference between the behavior of pure aluminum and that of various alloys, but the ocular reaction tended to be more severe in the case of the higher doses. In other words, there is much less toleration for larger fragments than for smaller ones.

All of the fragments became coated with white powder, yellowish exudate, fibrin, and in late cases with jelly. Powdering and fragmentation occurred late, and in 6 cases the fragment was completely absorbed.

The effects on the eye included the development of the following lens opacities in 28 eyes: striae, dots, vacuoles, and irregular opacities. Of the opacities 5 were anterior capsular, 6 anterior cortical, 4 posterior cortical, 2 capsular imprints, and 3 complete cataracts. Quiet uveitis occurred in many cases. There were 10 cases of posterior synechias, 2 cases of iris bombé, and 14 cases of atrophy of the iris. The fundus presented pigmentation in 23 cases, localized choroiditis in 6, and retinitis proliferans in 3 cases.

Histologic investigations revealed hyalinization and vascularization of the cornea, iritis, and atrophy and abnormal pigmentation of the iris. Pathologic changes in the retina and choroid were present in many instances.

As a result of the clinical and experimental investigation it is concluded that the eye is by no means inert to aluminum.

Aluminum and its alloys produce widespread changes in the eye regardless of the size or position of the fragment. Although aluminum and its alloys are not so destructive to the ocular tissues as iron and steel, whenever possible they should be removed surgically. This applies especially to foreign bodies in the anterior chamber. However, in many cases technical difficulties preclude removal; for example, intravitreal fragments may have to be let alone unless their size is such that loss of the eye would be inevitable. JOSHUA ZUCKERMAN, M.D.

Ocular Infections. JOHN G. BELLOWS and CHESTER J. FARMER. *J. Am. Ass.*, 1947, 135: 491.

The authors report that streptomycin is useful for various infections caused by organisms either insensitive or resistant to sulfonamide compounds and penicillin. Streptomycin is bacteriostatic against certain gram positive organisms as well as against a variety of hitherto resistant gram negative forms.

For acute conjunctivitis, drops of streptomycin (10,000 micrograms per cubic centimeter) are instilled at 1 hour intervals during the waking hours (8 or 9 times a day) and continued for a period of 8 days.

Penetrability of the cornea to streptomycin may be increased by abrasion, inflammation, ion transfer, and by wetting agents.

Streptomycin is safe and nonirritating to the surface of the eyeball in concentrations up to 10,000 micrograms per cubic centimeter. Higher concentrations delay regeneration of the epithelium and may promote scarring and vascularization of the cornea.

Intraocular injections of 500 micrograms of streptomycin in 0.1 c.c. of isotonic sodium chloride solution may be administered. If the drug is injected within from 6 to 8 hours after inoculation as few as 25 micrograms of streptomycin have been found effective in the prevention of experimental beta hemolytic streptococcic infections of the vitreous.

Experimentally, corneal infections caused by the Bacillus pyocyaneus are completely controlled by 3 instillations of streptomycin drops (10,000 micrograms per cubic centimeter) if made at 2 hour intervals within from 6 to 8 hours after inoculation.

Streptomycin was employed in 23 clinical cases of ocular infection. It was exceptionally effective in a case of primary meningococcic conjunctivitis and in a case of Bacillus pyocyaneus infection of the cornea.

In most cases of acute or chronic infections of the conjunctiva and cornea, organisms are rapidly eliminated by streptomycin therapy and, in the absence of complicating factors, rapid healing ensues.

JOSHUA ZUCKERMAN, M.D.

The Distribution of Penicillin in the Eye after Subconjunctival Injection. ARNOLD SORSBY and J. UNGAR. *Brit. J. Ophth.*, 1947, 31: 517.

The authors discuss the distribution of penicillin in the eye following subconjunctival injection of the drug. Adequate intraocular concentrations of penicillin can be achieved by systemic administration of massive doses, by the application of highly concentrated ointments, and by subconjunctival injections. The highest and most persistent intraocular concentration can be obtained by subconjunctival injection, especially when the penicillin is combined with epinephrine hydrochloride solution (1:1000) as a solvent.

Subconjunctival injection of 50,000 units of penicillin produces high intraocular levels. The introduction of ointment in concentration of up to 40,000 units per gram does not maintain any adequate intraocular levels after 2½ hours, neither does systemic administration of the drug. The overwhelming advantages of subconjunctival injections are beyond question.

It is pointed out that an injection of 50,000 units is preferable to one of 20,000 units because the former not only gives a considerably and disproportionately higher level of intraocular concentration but this level is maintained for a longer period of time. Injections should be given at intervals of 6 hours to maintain adequate levels.

Normal saline solution as a solvent is unsatisfactory because penicillin dissolved in it becomes a hypertonic solution. Adrenalin as a solvent has many advantages. Two per cent novocain hydrochloride solution may also be used as a solvent in painful eyes. JOSHUA ZUCKERMAN, M.D.

Streptomycin in Ophthalmology. J. G. BELLOWS and C. J. FARMER. *Am. J. Ophth.*, 1947, 3: 1215.

The authors describe the use of streptomycin in ophthalmology. Although thousands of strains and species of actinomyces, fungi, and bacteria have been investigated for antibiotic action and therapeutic usefulness, only penicillin and streptomycin have proved to be of therapeutic importance. Penicillin is more valuable, but streptomycin has been found to be superior to penicillin in the control of certain specific organisms.

Streptomycin is safe and nonirritating to the surface of the eyeball in concentrations up to 10,000 mcgm. per milliliter. Higher concentrations delay regeneration of the epithelium and promote scarring and vascularization of the cornea.

Intravitreal injections of 500 mcgm. of streptomycin in 0.1 ml. of saline solution are well tolerated. Effective therapeutic concentration is maintained in the vitreous for more than 24 hours by intraocular injection of 100 mcgm. of streptomycin.

Because local application of streptomycin decreases the amount of secondary infection accompanying vaccinia infections of the cornea, treated eyes become less scarred and less vascularized.

JOSHUA ZUCKERMAN, M.D.

A Statistical Study of Glaucoma. J. C. HOLST. *Am. J. Ophth.*, 1947, 30: 1267.

The author made a statistical study of glaucoma. He reports that at the University Eye Clinic in Oslo between 1920 and 1929 among 24,127 admissions (55 per cent men, and 45 per cent women) there were 2167 cases of glaucoma divided as follows: 2,024 cases of glaucoma simplex of which 63 per cent were in men and 38 per cent in women, and 143 cases of congestive glaucoma, 35 per cent of which were in men and 64 per cent in women. Glaucoma simplex constituted 93.4 per cent of all of the cases, while congestive glaucoma constituted only 6.6 per cent.

Hypermetropia occurred in fully 25 per cent of the cases, emmetropia in 50 per cent, and myopia in 19 per cent; almost 5 per cent of the cases were astigmatic. In this series of cases the preponderance of emmetropia was very marked.

Three hundred and seventy five cases (82 per cent) of 459 examined for the possible presence of exfoliation of the lens capsule presented this condition. In the 53 cases of unilateral glaucoma in which exfoliation was found on only one side, it was always in the glaucomatous eye. JOSHUA ZUCKERMAN, M.D.

An Operation for Trachomatous Pannus. M. LOMBARDO. *Am. J. Ophth.*, 1947, 30: 1109.

The author described a surgical method for the treatment of severe and persistent cases of trachoma with pannus formation. Since he believes that the presence of capillaries in the superficial layers of the cornea is essential to the formation of the trachomatous pannus, and since these capillaries are seen to spring from the blood vessels of the conjunctiva, he reasoned that the best treatment for this condition would be to remove the conjunctiva from the limbal region permanently. The operative procedure was as follows:

The conjunctiva was incised as close to the limbus as possible and then dissected all around to the limits of the fornices. The subconjunctival tissue was then carefully removed for about 6 millimeters around the limbus to leave a very clean sclera. The remnants of the conjunctiva at the limbus were curetted away and the active blood vessels in the cornea were split with the point of a cataract knife. One needle of a double armed silk suture was inserted in the scleral side of the conjunctiva in the superior temporal quadrant about 10 millimeters from its margin, passing parallel to the margin for about 6 millimeters and then coming back through the conjunctiva. Both ends of the suture were then carried up between the sclera and the conjunctiva to emerge through the skin under the brow where they were tied over a small roll of gauze. This procedure was followed in all 4 quadrants. The conjunctiva was held at an equal distance from the limbus all around the cornea.

The advantage of this operation was that there was a permanent disappearance of the blood vessels from the cornea with a consequent recovery from the pannus.

In the author's 7 cases there was more or less clearing of the corneal opacities without further ulceration of the corneas. The shrunken fornices were deepened. ROGER H. JOHNSON, M.D.

Vertical Motor Anomalies. Discussion of Miss Kramer's Paper. MARY EVERIST KRAMER and E. A. W. SHEPPARD. *Am. J. Ophth.*, 1947, 30: 1113.

This article is based on the study and treatment of 67 cases of vertical squint, most of which were complicated by lateral deviation. The author listed 5 types of recognized vertical deviations: (1) concomitant, (2) vertical, due to nuclear and infranuclear paresis, (3) vertical, due to supranuclear paresis, (4) pseudoparetic hyperphoria, and (5) vertical, of dissociated type. The value of making an accurate diagnosis was stressed.

In concomitant hypertropia the amount of vertical deviation is approximately equal in the whole field of fixation and, often, fusion training will relieve the patient of his symptoms but will not correct the hypertropia. At this time attention should be given to the lateral fusional range. The treatment of a paretic hypertropia is not orthoptic but medical and surgical. Fusional training, however, is often highly beneficial in recovered cases of pareses in that it makes for better co-ordination of the 2 eyes in binocular vision. The vertical deviations due to a supernuclear paresis are not within the realm of orthoptics and therefore are not discussed. Pseudoparetic hyperphoria is characterized by overaction of the inferior oblique muscle without a deficiency of the superior oblique muscle of the same eye or the superior rectus muscle of the opposite eye. Hyperphoria is not present in the primary position. No orthoptic treatment is indicated unless the patient is having symptoms, although most vertical phorias have a coexisting lateral component, which, when corrected, frequently causes the disappearance of the pseudoparetic hyperphoria. Dissociated vertical divergence is characterized by a variable hyperphoria of the eye which is not fixing and is the most amenable of all vertical motor anomalies to orthoptic treatment. Surgery is contraindicated.

Orthoptically, the treatment of these vertical phorias is essentially the establishment of good fusion and the correction of the amblyopia which is frequently present. Dissociation training aids in teaching voluntary control of the vertical deviation. A cure has been effected only after the dissociation exercises both for near and distance can be accomplished with comparative ease and good binocular stability is established. ROGER H. JOHNSON, M.D.

Mycotic Obstruction of the Nasolacrimal Duct (Candida Albicans). MAX FINE and WILLIAM S. WARING. *Arch. Ophth.*, Chic., 1947, 38: 39.

The authors present their observations in 2 cases of obstruction of the nasolacrimal duct by fungi. Fungi, especially streptothrix and leptothrix, often produce obstruction of the lacrimal passages. In most cases the obstruction consists of mycotic concretions in the lacrimal canaliculi; in only a few cases is the obstruction situated in the nasolacrimal duct.

An intensive study of the mycotic flora of normal and of diseased eyes by Fazakas revealed that, in descending order of frequency, the following fungi were recovered most often. Penicillium, Torula, Alternaria, Schizosaccharomyces hominis, Haplographium, and Aspergillus. Actinomyces is most often encountered in concretions of the canaliculi.

Two cases of mycotic obstruction of the nasolacrimal duct are reported. The yeast was identified as corpus albicans in 1 case, and the organism was not identified in the other case.

Immediate and spontaneous recovery followed extrusion of a castlike obstruction of the duct.

JOSHUA ZUCKERMAN, M.D.

Local Penicillin Therapy of Hypopyon Formation, with Special Reference to the Use of Subconjunctival Injection. ARNOLD SORSBY and HOWARD REED. *Brit. J. Ophth.*, 1947, 31: 528.

The authors discuss not only the ocular indications for the use of penicillin locally but also the optimal methods for its employment locally.

In order to be effective, drops have to be instilled at frequent intervals. Lamellae have not proved satisfactory. Ointments present difficulties concerning the best base to employ. Solid penicillin is effective when applied directly to an infected ulcer (Juler and Young, 1945).

Subconjunctival injection of penicillin was found superior to all other modes of applying penicillin. The following method of treatment is employed:

1. A smear is taken for culture purposes.
2. The conjunctiva is anesthetized by instillation of several drops of a local anesthetic.
3. A half cubic centimeter of 2 per cent novocain solution and 0.5 c.c. of epinephrine hydrochloride (1:1000) is injected into an ampoule containing 100,000 units of white crystalline penicillin. A half cubic centimeter is then withdrawn and injected subconjunctivally.
4. Atropine is instilled, and the eye may be bandaged.
5. Injections are repeated at 6 hour intervals for 3 days, a total of 12 injections being given in all cases. If indicated, another 4 injections may be given over an additional day.
6. After the injections are discontinued, penicillin ointment in a concentration of 100,000 units per gram is introduced every 4 hours day and night. The ointment is made with a specially prepared base of 90 parts of petroleum jelly and 10 parts of liquid paraffin. Use of the ointment is continued for 48 hours after apparent clinical cure.

In other words, from 12 to 16 subconjunctival injections are administered at intervals of 6 hours. Each injection contains 50,000 units of penicillin (dissolved in 0.25 c.c. of 2 per cent novocain and 0.25 c.c. of 1:1000 adrenalin). This treatment is followed by the introduction of penicillin ointment every 4 hours in a concentration of 100,000 units per gram.

It is pointed out that if no substantial response is obtained at the end of 48 hours, further injection of penicillin is useless.

A series of 66 patients with hypopyon was treated with penicillin. There were 39 cases of infected corneal ulcer, 18 of which were treated by subconjunctival injections of penicillin in doses of 50,000 units, with or without the application of penicillin ointment. Infected corneal ulcers responded well to treatment. Eighteen of 21 cases of infected corneal ulcer with hypopyon responded to subconjunctival injections. Hypopyon associated with herpetic or neuropathic keratitis gave no response. Hypopyon iritis required no treatment other than atropine.

General sulfonamide therapy was used in 3 patients when subconjunctival injections of penicillin were inadequate. JOSHUA ZUCKERMAN, M.D.

Bilateral Uveitis from Horse Serum. T. F. SCHLAEGEL, JR. *Am. J. Ophth.*, 1947, 30: 1225.

The author describes the development of bilateral granulomatous uveitis in rabbits after the use of normal horse serum.

In every case in which the right eyes of rabbits were injected with serum and later given repeated large doses intravenously the reaction was severe in the injected eyes and moderate in the uninjected.

The uvea revealed infiltration by lymphocytes, large mononuclear phagocytes, plasma cells, and epithelioid cells. Injected eyes developed replacement fibrosis and involvement of the retinas, whereas the infiltration in the unaffected eyes remained fresh and the retinas were not affected.

A second series of experiments was performed to elucidate the mechanism of this contralateral response. The rabbits received the original injection intracutaneously instead of into the right eye.

Not only the clinical but also the microscopic reactions in the uninjected eyes of the first series were significantly greater than the reactions in the uninjected eyes of the second series. The cause of this apparent superiority of the eye over the skin for predisposition to a reaction in uninjected eyes was not determined. JOSHUA ZUCKERMAN, M.D.

Penicillin Therapy of Experimental Infections of the Lens and Vitreous with Clostridium Welchii. LEON C. HOSKINS. *Arch. Ophth.*, Chic., 1947, 38: 301.

The author discusses penicillin therapy of infection of the eye by Clostridium welchii. Infections of this type which are relatively common among battle casualties are now effectively controlled by penicillin. Because penicillin iontophoresis failed to check infection of the lens by this organism, experimental infection of the lens and vitreous was undertaken.

Hoskins found that direct injection of penicillin into the lens and vitreous satisfactorily controlled infections with the Clostridium welchii if the therapy was instituted within 3 hours after the inoculation.

The results were less favorable when the interval between the infection and the treatment was increased to 6 hours.

In a series of 3 hour cases a beneficial effect was obtained with only moderate damage to the structures of the eye. JOSHUA ZUCKERMAN, M.D.

Dicumarol and Rutin in Retinal Vascular Disorders. ANGUS L. MACLEAN and CHARLES E. BRAMBEL. *Am. J. Ophth.*, 1947, 30: 1093.

The purpose of the authors was to present the concomitant use of dicumarol and rutin in vascular retinopathies. The mechanism of retinal venous occlusion was presented as a slowing of the blood flow followed by the formation of a roughened area on the endothelium, upon which cells and fibrin are deposited so that an organized thrombus protrudes into the lumen of the vein. When dicumarol is administered orally the prothrombin activity of the blood is reduced and intravascular thrombosis as well as intravascular coagulation is inhibited. In this manner the enlargement of the clot by continued fibrin deposition may be prevented. The preformed thrombus, if its growth is checked, may leave a lumen for the passage of blood. Rutin was used to decrease capillary fragility when present.

In this series of 21 cases dicumarol was given in dosages to maintain a coagulative activity level at 50 per cent of the normal. In more than one-half of the cases rutin was usually given orally at the same time in 60 milligram doses daily. The dicumarol produced a minimum of untoward side reactions and no toxic manifestations were observed from the rutin.

The present series of cases of various retinopathic conditions manifested a definite decrease in the prothrombin clotting time compared to normal controls. Dicumarol and rutin therapy in 2 cases of tributary occlusion showed an increased rate of improvement, but in 6 cases of central vein occlusion the rate of recovery was variable. Four patients with diabetic retinopathy presented improvement of their visual acuity and absorption of hemorrhages when treated with dicumarol and rutin. The retinopathic condition manifested by macular and premacular edema with attenuated vessels was cleared in a short time with rutin and dicumarol. Two patients with Eales' disease were found to have a strongly positive Gothlin index and rutin alone produced improvement.

The primary etiologic factor of degenerative retinopathy probably rests upon vascular sclerosis with the secondary process of thrombosis. Dicumarol therapy produced an improvement in all cases of this type. ROGER H. JOHNSON, M.D.

The Treatment of Traumatic Diplopia. J. C. NEELY. *Brit. J. Ophth.*, 1947, 31: 581.

The author reports his findings concerning the incidence and causes of accommodative asthenopia and discusses the treatment of traumatic diplopia.

Before the war there was no recognized technique for correction of traumatic diplopia.

As far as the vertically acting muscles are concerned it is not necessary to obtain orthophoria in

order to relieve the most nauseating and distressing of symptoms—diplopia. Diplopia may be associated with mental confusion and headache. Following reduction of the vertical deviation by surgical procedures, binocular reflexes assisted by orthoptic training maintain fusion within the range of normal ocular movement. Orthoptic exercises prevent suppression in the affected eye and maintain the tone of the extraocular muscles. If the deviation is marked it may be corrected in stages to avoid possible overcorrection with resultant relative paresis. After operation exercises will strengthen the binocular reflexes and increase the fusion hold of the newly restored binocular vision Residual defects can then be corrected.

Neely points out that traumatic diplopia is not an uncommon sequel to head injuries; that the diplopia usually results from paresis, not from paralysis of an extraocular muscle; that the diplopia is caused by a "closed" head injury rather than by a penetrating head wound; that the vertically acting muscles are most often affected; that injuries to the orbit may be overlooked or masked by swelling of the surrounding tissues; and that roentgen ray diagnosis of fractures of the floor of the orbit is difficult unless stereoscopic plates are taken.

Fractures which involve the orbit require restoration of the normal anatomy of the parts and building up of the orbital floor by means of a bone inlay. To overcome the residual diplopia and restore binocular single vision, eye muscle surgery aided by orthoptic exercises is required.

JOSHUA ZUCKERMAN, M.D.

NOSE AND SINUSES

Role of Penicillin in the Management of Acute and Chronic Frontal Sinusitis. KENNETH M. KAHN. *Arch. Otolar.*, Chic., 1947, 46: 293.

Seven patients with sinus disease were treated with penicillin plus indicated surgical measures. In the 6 cases in which suppuration was present, surgical measures were necessary for cure. Penicillin given in these cases prevented dissemination of infection by its bacteriostatic action. Twenty-five thousand units were given intramuscularly every 3 or 4 hours. One patient with a complicating meningitis was given 50,000 units intramuscularly every 3 hours and 15,000 units intrathecally daily. In 3 cases penicillin instilled into the wound through fixed ureteral catheters was considered to aid in early primary wound closure. JOHN R. LINDSAY, M.D.

Neurogenic Tumors of the Nose and Throat. GORDON B. NEW and KENNETH D. DEVINE. *Arch. Otolar.*, Chic., 1947, 46: 163.

In the last 27 years at the Mayo Clinic, 33 cases of neurogenic tumors in the nose or throat have been encountered. These include 9 cases of developmental error and 24 cases of neoplasm.

There were 6 cases of meningocele. Four of the meningoceles were large, pulsating, compressible, congenital tumors at the root of the nose. In another case there was a small, firm, rounded mass at the root of the nose, which was thought to be a dermoid cyst. At the time of operation it was recognized as a meningocele and the pedicle was ligated. In 1 case the tumor presented as a cyst of the nasal cavity. Meningoceles are neurosurgical problems.

There were 3 cases of encephalocele. The tumors were firm, rubbery, round, congenital tumors at the root of the nose lying just to the right of the midline. Small external encephaloceles with no intranasal or intracranial connections are best removed through a horizontal incision over the root of the nose. These tumors are not encapsulated and must be removed by sharp dissection, care being taken to remove all of the tumor.

An intranasal encephalocele may have intracranial connections. For this reason, any surgical procedure for its removal must furnish adequate exposure so that the distal pedicle or attachment of the tumor may be ligated or electrocoagulated if there is any evidence of intracranial connection.

There were 19 neurofibromas. Among these 19 cases there were only 4 of Recklinghausen's disease. Neurofibromas of the oropharynx, hypopharynx, and tonsillar region are best attacked surgically through the mouth after preliminary ligation of the external carotid artery on the side involved. They shell out easily from the capsule and rarely recur. An occasional pharyngeal neurofibroma may be so large that it is necessary to do preliminary tracheotomy. It is usually necessary to approach these large tumors through an external incision. If the location of the tumor prevents shelling it out, destruction of the tumor by surgical diathermy may be necessary.

There was only 1 ganglioneuroma. This was a firm tumor involving the left basal region of the tongue, extending forward to a point opposite the bicuspid area, back almost to the tip of the epiglottis, and down through the floor of the mouth, where it presented in the left submaxillary region. After preliminary ligation of the left external carotid artery, the tumor was removed through the mouth.

There were 4 cases of meningioma. In 3 cases the tumor was in the frontal sinus and in 1 case it was located subcutaneously at the root of the nose. Meningiomas in the nasal sinuses and located subcutaneously at the root of the nose are best removed by surgical diathermy.

MOUTH

Prosthetic Restoration of Palate. V. H. KAZANJIAN. *J. Oral Surg.*, 1947, 5: 181.

The author discusses the value of various types of prosthetic appliances which may be utilized along with, or following, surgical procedures for the correction of deformity of the upper jaw.

Deformities of the maxilla may be congenital or acquired. Cleft palate is the most common congenital deformity. Prostheses are of value when surgery results in failure, or only partial success. After suc-

cessful operations have been performed in infancy retrusion of the upper middle half of the face and gross irregularities of the teeth often result. Artificial palates are of two types: those which are movable and under control of the muscles of the soft palate, and those of the stationary type which form contact on their lateral and posterior surfaces with the muscles of the palate and pharynx. The movable appliance may leak air at the point of contact with its supporting denture and occasionally requires repair. The stationary denture creates more strain on supporting teeth and is not desirable in the absence of adequately sound teeth.

Retrusion of the upper jaw is often seen in young adults because of a lack of underlying support of the alveolar bones. The Estlander-Abbe operation has given good results in those patients with an underdeveloped upper lip. The operation consists of a two-stage transfer of a measured triangular flap from the midline of the lower lip to the upper lip.

Acquired deformities occur as the result of injury or disease, or by operative treatment for malignancy. Use of an immediate denture in operative defects prevents secondary contractions and adhesions of the soft tissue and contributes to the patient's comfort. Prosthetic appliances may be anchored to the remaining alveolar ridges, palate, and teeth. Spaces leading to the nasal cavity may also be used as means of retention. It is sometimes advisable to incise adhesions of the mucous membrane and apply a skin graft within the oral or nasal cavities to give better membranous lining for toleration of the denture. Spiral springs with attachments from the lower jaw to the upper prosthesis are of some value when other methods of retention fail. Surgical measures are necessary to make the prostheses possible and should be made to harmonize with prosthetic procedures to be used in each case.

Ten case histories with excellent diagrams and photographs illustrating different types of prosthetic appliances are presented. JOHN R. LINDSAY, M.D.

Partial Denture Prosthesis for War Injuries. LOUIS EMORY. *J. Am. Dent. Ass.*, 1947, 35: 634.

The surgical treatment of maxillofacial injuries has received a great deal of notice in the literature but, as the author of this report says, little or no reference has been made to the artificial restoration of lost parts of the jaw and face. The restoration of function and esthetic substitution for the lost parts is the duty of the well trained dentist, continually working hand in hand with the surgeon. The author emphasizes the necessity for the early combined efforts of these two, but points out that a thorough understanding of the basic principles and engineering skill of the most exacting prosthodontic type are required and the work may perhaps require a long period of time. In other words, no case is static and each one may require—more often than not—constant alteration, not only to fit in with the changing surgical situation but also to assure comfort and to fulfill the functional requirements.

This article deals only with partial denture restorations. The illustrations and discussion give a rather clear, though concise, description of the conditions which may be encountered. The bibliography is fairly complete. WILLIAM G. SKILLEN, D.D.S.

NECK

Papillary Cystadenolymphoma. KARL-GUNNAR TILLINGER. *Acta. radiol.*, Stockh., 1947, 28: 241.

Cystadenolymphoma occurs principally in elderly persons, their average age being about 56 years. The great majority of the patients have been men. This condition progresses slowly, generally over a period of several years, and the tumor may become quite large. A differential diagnosis between this condition and other tumors of the parotid area is almost impossible. The diagnosis is made by microscopic examination. Most of these tumors have a distinct capsule and may be easily shelled out. Recurrences were noted in only 2 cases and the recurrence resembled the original tumor. No cases have shown malignant degeneration. Cystadenolymphoma has no typical macroscopic differentiation. The microscopic findings are highly characteristic—one portion being epithelioadenomatous and cystopapillary, and one being lymphoreticular resembling a lymph node.

Nine case reports are presented in abstract. These tumors had been observed primarily in the parotid area; only 5 were in the submandibular region while none was in the sublingual region.

RICHARD J. BENNETT, JR., M.D.

Simultaneous Chromaffin Tumors of the Carotid Body and the Glomus Jugularis. G. F. KIPKIE. *Arch. Path.*, Chic., 1947, 44: 113.

A case is presented in which there were multiple tumors arising in the chromaffin system. One tumor was found in the carotid body on the right side of the neck and the other tumor was found in the petrous portion of the temporal bone. This recently recognized body is known as the glomus jugularis. It appeared that the tumor of the petrous portion of the left temporal bone had been present for 5 years before the tumor of the right side of the neck was discovered.

In the report of the single case, there was nothing unusual in the physical examination except the 2 tumors. Biopsy specimens taken before death showed a pathology similar to that of the tumors found post mortem. The tumor of the petrous portion of the left temporal bone would appear to have been present for at least 10 years since it was incompletely removed at the primary mastoidectomy.

RICHARD J. BENNETT, JR., M.D.

Intrinsic Cancer of the Larynx. Review of a Series of Cases. V. E. NEGUS. *Proc. R. Soc. M.*, Lond., 1947, 40: 515.

Among 502 lesions of the upper portions of the respiratory and alimentary tracts, observed by the

author over a period of 20 years, 93 were intrinsic and 94 were extrinsic laryngeal cancers.

Of the intrinsic cancers, 54 were unilateral (41 cordal, 7 subglottic and 6 supraglottic) and 39 were bilateral (10 limited and 29 diffuse). There were 90 males and 3 females. The ages of the patients ranged from 26 to 80 years, the majority being from 50 to 60 years. Age had no apparent relation to the prognosis since the percentage of "cures" was similar in all age groups. The lesions were squamous cell carcinomas except for an epithelioma (Broders' group 4) in 1 case. Seventy-nine of the 93 patients were treated by the author.

The pathological sections of 42 lesions were graded according to Broders' classification. Success is defined as absence of recurrence at the end of 5 years. Results were listed as promising if there was no recurrence during a period of observation of less than 5 years.

In group 1 there were 4 failures and 4 successes; in group 2, 9 failures and 14 successes; in group 3, 4 failures and 4 successes; in group 4, 3 failures (no successes).

Of 35 patients treated for unilateral cord cancer, 10 were cured and in 11 patients the results were promising; of 5 with unilateral subglottic growths, 1 patient was cured and in 1 the results were promising; of 5 patients treated for unilateral cordal and subglottic cancer, 1 patient was cured, and the results were promising in 2; of 32 patients with bilateral intrinsic laryngeal cancer, 7 were cured and in 7 the results were promising.

Laryngofissure, laryngectomy, and irradiation with interstitial radium, radium collar, radium beam, and deep x-ray therapy were the methods of treatment. The type of treatment was selected according to the site and extent of the tumor.

After his experience of 20 years, the author suggests that growths limited to the membranous vocal cord are best treated by laryngofissure. A unilateral cord growth extending to the posterior arytenoid cartilage or the posterior commissure is treated by external irradiation or interstitial radium. A diffuse growth should be treated by total laryngectomy.

CLINTON H. THIENES, M.D.

Methylthiouracil in the Treatment of Thyrotoxicosis. ARNE BARFRED. *Am. J. M. Sc.*, 1947, 214: 349.

The first group of patients to be treated with methylthiouracil had iodine resistant thyrotoxicosis and were given large doses of the drug (1 gm. or more a day). Forty-four per cent developed such severe toxic reactions that the drug had to be discontinued, but 7 per cent were treated successfully.

The second group of patients treated with this drug had not received iodine to any extent before the administration of methylthiouracil. In this group smaller doses of the drug were used, and the authors now believe that the dose should not exceed 0.4 gm. a day. There were 43 patients in this group: in 5, or 12 per cent, the treatment had to be stopped because of toxic reactions, and in 37, or 86 per cent, the treatment was considered to be effective. The dosage was gradually decreased and when the patient had done well for a month on 0.05 gm. a day, the drug was completely withdrawn, usually after an average period of 5 months.

Of the patients effectively treated with methythiouracil, 36.4 per cent maintained a sustained remission after withdrawal of the drug and were considered cured of their thyrotoxicosis, while 27.2 per cent suffered a remission after withdrawal of the drug. Thus, in starting methylthiouracil treatment only one-fourth of the patients may be expected to be cured. Some of the author's cases were apparently methylthiouracil resistant cases.

The author concludes that methylthiouracil is a more powerful antithyroid drug than thiouracil, but that the toxic reactions of the two drugs appear to be about equal. He believes that antithyroid drugs are contraindicated in large intrathoracic goiters, in large goiters causing pressure symptoms, in noncooperative patients, in thyrotoxicoses which are due to acromegaly, and possibly in thyrotoxicoses associated with pregnancy. He found that the test for urobilin in a 1:10 dilution of urine was a particularly sensitive one for early toxicity, thus confirming other reports that liver damage is often one of the earliest signs of toxicity.

F. J. LESEMANN, JR., M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Bell's Palsy: Pathology and Surgery; A Report Concerning 50 Patients Operated on by the Method of Ballance and Duel. KARSTEN KETTEL. *Arch. Otolar.*, Chic., 1947, 46: 427.

Since 1932, when Ballance and Duel began operating on patients with Bell's palsy by opening and decompressing the fallopian canal from the stylomastoid foramen to the lateral semicircular canal, investigation as to the etiology, pathology, and therapy of this disease has actively progressed. The present study is based on observations made in 50 operative patients, with consideration to the pathogenesis of the condition and the value of the decompression operation.

Previously the gross and microscopic pathology of the facial nerve and the surrounding region has revealed alterations of the axis cylinders and medullary sheaths, usually greater in the peripheral portions. Occasionally degenerative changes were noted in the facial nuclei. Inflammatory changes have been rare. A few authors have found distinct alterations in the cells of the mastoid process along the facial canal and others have described edema of the facial nerve in instances of recent paresis and atrophy in chronic cases.

In the series of cases here summarized, extensive bony necrosis of the mastoid cells was observed in 11 patients (20 per cent). In 5 this involved the entire cellular system and had been noted roentgenologically, whereas in 6 it was found only in the apex of the mastoid process, especially about the region of the stylomastoid foramen. Microscopically there was slight osteoporosis and bony necrosis. There was no suggestion of any inflammatory process. The facial canal was grossly soft in 18 patients (36%), while in all of the others it appeared normal. In 28 patients (56%) the nerve was unquestionably edematous grossly, in 2 it was possibly atrophic, and in 1 patient the changes were so marked that nerve continuity was interrupted. In this instance microscopic examination revealed nerve trunk edema, fibrinous exudation, fresh hemorrhage, and marked degeneration of the axis cylinders and medullary sheaths. There were remnants of a venous thrombosis in the nerve sheath.

Previous authors have suggested that Bell's palsy is due to an inflammation (a latent nonsuppurative otitis media) or an aseptic disturbance of the blood supply. Numerous observations support the theory that the genesis of this disease is due to a disturbance of the vasa nervorum and this theory is held by the author on the basis of his pathological and clinical studies. In the majority of cases the nerve, as the most susceptible tissue, suffers alone; in others the surrounding, more resistant, bone is affected. The result is ischemic paralysis and ischemic bony necrosis. All symptoms and findings are thus explained by ischemia of the facial nerve and the mastoid region. The rapidity of paralysis and its progression depends upon the vessel size, degree of ischemia, and re-establishment of the circulation.

Since previous experience has shown that the great majority (from 85 to 90%) of the cases respond to conservative treatment, the problem arises as to which patients to select for operative intervention. The faradic reaction has been used by previous investigators as a reliable index, but the author does not concur in this opinion. Cases are cited in which a negative faradic response was obtained but complete recovery took place later. The author gives 3 indications for the surgical treatment of Bell's palsy:

1. A decompression should be done in cases in which signs of beginning mobility have not appeared after an observation period of 2 months.

(Of 25 patients operated upon, 20 were ready for re-examination. Two had recovered completely. No patient showed any weakness when the face was at rest and all of the patients could close the eye completely and smile, but to a varying degree.)

2. A decompression should be done if the spontaneous recovery of mobility has ceased before complete restitution has been obtained.

(Of 17 patients operated upon, 13 were ready for re-examination. Nine patients showed improved mobility and 1 patient had recovered complete mimicry. One obtained relief from a contracture which had formed before operation. In 3 patients the procedure was of no benefit.)

3. Decompression is indicated in relapsing paresis. Of 8 patients in this group, 2 recovered completely and the mobility increased in all.

The beneficial effect of decompression of the facial nerve in cases of Bell's palsy is believed to be due to improvement of the blood flow by release of pressure on the vasa nervorum or by the establishment of a collateral circulation. C. FREDERICK KITTLE, M.D.

SPINAL CORD AND ITS COVERINGS

Relations of Nerve Roots to Abnormalities of Lumbar and Cervical Portions of the Spine. J. JAY KEEGAN. *Arch. Surg.*, 1947, 55: 246.

Results of careful neurological observations are presented on 1,128 cases of compression, injection, or section of single posterior nerve roots. Of these, 1,030 were in the lower extremity, 588 being verified by surgical intervention. Ninety-eight were in the cervical region, and 31 of these were treated surgically.

It is postulated that loss of a single nerve root produces an area of hypalgesia, in contrast to the previously accepted dictum that such a loss causes no sensory disturbance.

If vertebrae are counted in total numerical sequence and not by arbitrarily defining regions, e.g., the lumbar region as bordered by the last rib and first sacral segment, no alteration in the segmental distribution of nerve roots is noted despite the addition or fusion of vertebrae. This method of terminology is recommended for describing the location of a herniated disk. A new dermatome chart of the upper and lower extremities is given based on hypalgesic patterns from loss of a single nerve root. This does not support the usual anatomic teaching of great variation and forward transmutation of nerve loops and sensory areas in the developing limb buds. Instead, when added to the usual dermatome chart of the trunk, it presents an orderly sequence of innervation of skin areas in direct numerical relation to the nerve roots. (See Fig. 1).

C. Frederick Kittle, M.D.

PERIPHERAL NERVES

Observations on the Treatment of Traumatic Injuries of the Peripheral Nerves. Sydney Sunderland. *Brit. J. Surg.*, 1947, 35: 36.

Two hundred and ninety-four patients with 339 peripheral nerve injuries incurred by war wounds and related injuries were observed for periods up to 6 years. Unexpectedly favorable results were obtained by conservative treatment. This was imposed by circumstances at first, but was later pursued deliberately.

With exclusion of ulnar transpositions, 68 per cent of the patients recovered spontaneously, 1 per cent refused operation, and 31 per cent were explored surgically; of the last, 17 per cent were subjected to suture, 1 per cent to grafting, 1 per cent had a cervical rib removed, 6 per cent had damage beyond repair, and 6 per cent had some nerve tissue continuity and subsequently recovered spontaneously.

Lesions due to projectiles showed a high incidence of spontaneous recovery. The incidence of irreparable gunshot injuries of the radial and sciatic nerves increased when the corresponding long bone was injured.

Three factors should be considered as indicating the severity of peripheral nerve injury:

1. Degree of interruption of nerve conduction.

2. Duration of the latent period: the time required for return of complete or partial function.

3. Appearance of the nerve at the site of injury (laceration, hemorrhage, subsequent neuroma formation). The presence of neuroma formation does not preclude recovery of the nerve and should not be regarded as justification for resection and suture.

Exploration as soon as local conditions permit is advocated, but nerve continuity should be preserved regardless of its appearance until opportunity has been given for spontaneous recovery. If a nerve has been exposed and treated conservatively, and does not show signs of recovery after from 6 to 9 months, re-exploration and repair should be undertaken.

C. Frederick Kittle, M.D.

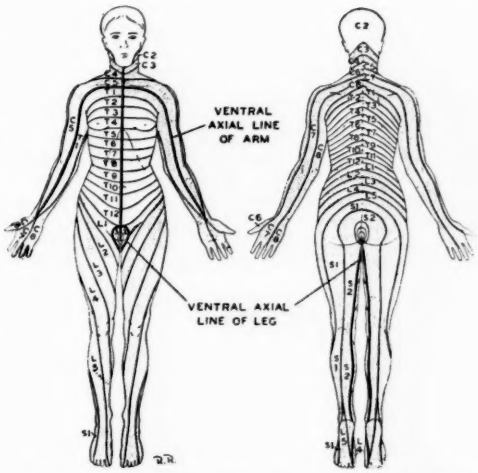

Fig. 1. (Keegan) Dermatome chart of the human body with new dermatome patterns of the extremities combined with standard dermatome patterns of the trunk. Note the serial continuity of the dermatomes in the extremities, as in the trunk. (See p. 234 for abstract).

How Long Should an Extremity be Immobilized after Nerve Suture? I. M. Tarlov. *Ann. Surg.*, 1947, 126: 366.

End-to-end suture of a nerve is hardly ever possible without the use of various procedures for overcoming gaps which result from the loss of substance of nerves or the retraction of their stumps. The methods commonly used for gaining length consist of the often extensive freeing of the nerve, rerouting, or suturing it with the neighboring joints flexed. Even when these steps are taken it is sometimes necessary to introduce nerve grafts, but end-to-end suture is preferable to the use of grafts, provided that this can be accomplished without great strain on the suture line. In those instances in which joints must be flexed in order to bring nerve ends into apposition and remove tension from the suture line, the question arises as to how long the limb must be immobilized in the flexed position. The period of immobilization must be long enough to avoid rupture of the suture site when the joint is extended. Active and passive motion of the joint over which the sutured nerve passes must not be started before satisfactory healing of the suture line has occurred, but it must not be delayed unnecessarily beyond this point. An attempt has been made in this study to resolve this apparent dilemma by the performance of a series of experiments upon rabbits and dogs. Microscopic studies of the process of healing at the suture line together with determinations of the tensile strength of the sutured nerve were made.

Experiments were carried out in which both sciatic nerves in a series of 14 rabbits were exposed, severed

and then sutured by the use of the autologous plasma clot technique. Two of the 3 untwisted strands of No. 00 corticelli black silk were used as tension sutures to approximate the nerve ends, and accurate apposition was achieved with the aid of plasma clot. The animals were sacrificed at various intervals after operation, and 4 cm. segments of the nerve were removed (2 cm. to each side of the suture site). Also, 4 cm. segments of intact sciatic nerve were excised. The silk tension sutures were removed and tensile strength measurements were made of the suture site, the intact nerve, and of one of the withdrawn silk tension sutures from each nerve. For the purpose of microscopic study, the same technique of nerve suture was used upon the sciatic nerves of dogs, with the exception that tantalum wire (.003 inch in diameter), which causes less tissue reaction than silk, was used for tension sutures. Observations were made upon several hundred of such nerves at intervals ranging up to 18 months after operation. This material was prepared for study by a variety of histologic techniques.

The technique employed for the measurement of tensile strength was essentially that described by the author in a previous publication. Increasing increments of weights were applied until rupture of the nerve took place.

Histologic observations disclosed that a few monocytes and polymorphonuclear leucocytes appear within the plasma cuff as early as from 24 to 48 hours after nerve suture, and an occasional fibroblast may be seen at this time. The fibroblasts increase in number and a normal epineurium is reconstructed from the plasma sheath in from 7 to 10 days.

As early as from 3 to 5 days after suture, cells may be seen streaming across the suture line, but occasionally signs of such cellular proliferation are strikingly absent. Sections taken 9 days after operation have shown structural continuity of schwannian and endoneural sheaths, although not uniformly in all cases. In practically all sutures 18 days or, particularly, 3 or more weeks old, complete restoration of structural continuity has occurred. The growth of nerve fibers through the suture line may be demonstrated at this age.

Tensile strength determination confirmed that the suture site regained, or even exceeded, the strength of the intact sciatic nerve in 19, or more, days after operation. The nerves appeared to achieve a greater tensile strength value at a certain time when their ends were accurately coapted and well joined. It appeared that the general condition of the animal, too, played a role in governing the rate of healing at the suture site. The microscopic observations in dogs indicate that this statement applied also to this species since structural continuity at the suture line was found to be complete at approximately this time. It seems justifiable then to advocate the removal of plaster of Paris encasements or other means of limb fixation 3 weeks after nerve suture and the institution of gradual extension of the joint at this time. There would be no danger of rupture of the suture site in well made unions when a nerve is subjected to any strain 3 weeks after suturing. However, there is no doubt that there is a limit to which a nerve may be stretched and yet remain capable of regenerating, with resultant functional recovery of the innervated part.

It is concluded that in those cases in which joints must be flexed in order to perform end-to-end suture of nerves and the extremity encased in plaster, the encasement may be removed 3 weeks later without danger of rupture of the suture site during the subsequent extension of the limb.

HOWARD H. LANDER, M.D.

Rate of Regeneration of Sensory Nerve Fibers. SYDNEY SUNDERLAND. *Arch. Neur. Psychiat.*, Chic., 1947, 58: 1.

Although Tinel's sign has been frequently studied in the estimation of rate of growth of peripheral nerves, the reports have failed to specify or emphasize at what period of regeneration this sign has been investigated, or if repeated observations were made at varying intervals. The present report does not attempt to correlate the morphologic study of the regenerating nerve fiber with Tinel's sign, nor the prognostic value of this sign.

The present study was derived from 11 patients with 12 peripheral nerve lesions. In 9 cases nerve suture was performed, while in 3 cases the lesion was of the type defined as axonotmesis. It is concluded that nerve regeneration as evidenced by Tinel's sign does not progress at a steady rate but by a progressively diminishing rate. In the early stages (the first 120 days) there was a decline from 2.5 (or possibly 3 mm. in the very early phase) to 2 mm. per day. An intermediate stage of from 120 to 200 days revealed the growth rate at approximately 1.6 mm. per day. The terminal stage (from 200 to 500 days) showed a further definite drop from 0.8 to 0.5 mm. per day.

In a previous paper the author reported his studies of the rate of regeneration of motor fibers by a completely different method, from which it was surmised that the rate of growth was of functionally mature motor fibers. The fibers found in that group were very similar to the present group of sensory fibers; hence, although the processes may not be similar there was no appreciable difference in the rates of advance of sensory or motor fibers as measured by dissimilar methods of investigation.

JACK I. WOOLF, M.D.

SYMPATHETIC NERVES

Surgical Treatment of Hypertension. REGINALD H. SMITHWICK. *J. M. Soc. N. Jersey*, 1947, 44: 304.

A report of the results obtained in 439 unselected hypertensive patients treated by lumbodorsal splanchnicectomy is made in this article. The possible causes of hypertension (increased peripheral resistance to the flow of blood through the arterioles, in particular) are mentioned, and the physiologic and

organic mechanisms behind these theories are outlined.

The operative exposure, including a paravertebral incision from the ninth rib to the iliac crest with removal of portions of the eleventh and twelfth ribs and division of the diaphragm, is described. This allows the removal of the sympathetic trunk from the eighth thoracic to the first lumbar ganglia, inclusive, but may be extended down to the second and third lumbar ganglia if necessary. The greater splanchnic is resected down to the celiac ganglion from the midthoracic region. The operation is bilateral, and is done in two stages, 8 to 10 days apart.

The details of preoperative study are outlined at some length, and a description is given of the stages and types of hypertension.

The results have been determined on the basis of the amount of drop noted in the diastolic pressure.

Group 1 includes those cases in which there was a drop of 20 millimeters or more, and to below 90; group 2 includes those cases in which the diastolic pressure is lowered 20 millimeters or more, but not to below 90; group 3 includes patients whose diastolic pressure was lowered less than 20 millimeters, or who showed no change at all; group 4 includes patients in whom the diastolic level and pulse pressure were essentially unchanged, but the ceiling levels were lowered; patients in group 5 showed no change in blood pressure; those in group 6 had higher blood pressures; those in group 7 died.

Patients in groups 1, 2, and 3 are believed to have been benefited.

The results obtained in the 439 unselected cases are as follows: 65.8 per cent of the patients are improved; the condition in 12.8 per cent of the patients is unchanged; 6.8 per cent of patients show a higher level of blood pressure; death occurred in 14.6 per cent of the patients. The cases have been followed up for periods of from 1 to 5 years.

Further "selected" cases are described, and the criteria for operation in the various groups are outlined in detail. The results following surgery in 319 selected cases were as follows: 84.8 per cent of the patients were benefited; 11.6 per cent were unchanged; 2.4 per cent had higher blood pressures; 1.2 per cent of the patients died.

HOWARD A. BROWN, M.D.

Regeneration after Sympathectomy and Its Effect on Raynaud's Disease. H. A. HAXTON. *Brit. J. Surg.*, 1947, 35: 69.

To ascertain the completeness of a sympathectomy, the author favors the use of the skin electrical conductivity test. Sweating skin conducts electricity more readily than dry skin and therefore has a low resistance. After a sympathectomy, the affected area's resistance increases a hundredfold. If one wishes to examine the skin electrical conductivity of the body generally, it will be an aid to place the person in an environment which encourages sweating. To test the extremities, however, this is unnecessary because the palmar surface of the digits is usually moist and can be readily tested without inducing sweating. The author believes this test to be much more delicate than the digital skin temperature.

Tests have been done following various types of sympathectomies and the following illustrates the degree of anhydrosis occurring after each:

Section of the cervical chain produces anhydrosis of the affected side of the face, neck, and upper thorax to below the clavicle. This corresponds to the distribution of the fifth cranial nerve and the first three cervical dermatomes.

Section of the thoracic sympathetic chain at the level of the third rib and at the upper end of the chain with division of the rami from the second and third thoracic nerves produces anhydrosis in the upper limb and in the upper thorax. Following surgery the hand is dry and warm, but the temperature gradually drops until it is a few degrees above the preoperative level. The removal of a 3 to 6 cm. segment at the third lumbar level produces anhydrosis of the foot and leg except for a small strip above the middle malleolus.

To study the results of these operations, tests were done on 46 upper and 38 lower extremities from 1 to 14 years after surgery. In all the extremities examined, with the exception of 7 lower extremities, some return of sympathetic activity was demonstrated. The patients' stories indicated that 18 of the upper extremities and 4 of the lower extremities had a recurrence of pain. The author believes that the relapse is due to a regeneration of sympathetic fibers and local sensitivity of the vessels to cold.

DANIEL RUGE, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Surgical Management of Large Defects of the Thoracic Wall. HERBERT C. MAIER. *Surgery*, 1947, 22: 169.

Large defects in the thoracic wall may result from the radical resection of tumors, from areas of radiation necrosis, and from trauma. Although the chest wall may be extensively involved by infection, destruction of the entire thickness over a large area is uncommon. If the loss of tissue of the thoracic wall involves only the skin, subcutaneous tissues, and extrathoracic muscles, the principles of management are similar to those followed when treating defects in other portions of the body. When the bony or cartilaginous structures are destroyed or removed over a considerable area, problems peculiar to the thoracic cage are encountered. If the defect extends into the pleural cavity, the problem of an open pneumothorax must be met.

The resection of several ribs, cartilages, or a large segment of the sternum deprives that portion of the chest wall of its normal stability and results in paradoxical motion. The degree of abnormal mobility on respiration will vary with the location and extent of the defect, and will also be influenced by the thickness of the soft tissues and other factors such as the presence of pulmonary emphysema. If the resection of the lesion of the chest wall requires the sacrifice of the parietal pleura, a flap of tissue must be made available for an airtight closure of the opening. Skin grafting alone would obviously be inadequate in such cases.

Local recurrence of carcinoma following radical mastectomy for cancer of the breast may merit surgical excision if there are no evident distant metastases. The value of such secondary operations is considerably enhanced if the procedure is of a radical type. Often the entire thickness of the thoracic wall from the skin to, and including, the parietal pleura should be excised. If the surgeon compromises in the extent of the excision in order to avoid a large defect or opening into the pleura, less satisfactory results will be obtained. When the resection includes the cartilages, ribs, intercostal structures, and parietal pleura, a flap of skin and subcutaneous tissues down to the deep fascia should be mobilized from adjacent areas and swung over the defect as a pedicle flap. Since the tissues in the region of the previous mastectomy wound are rather fixed and somewhat fibrotic, this pedicle flap should be fashioned from tissue which was not in the field of the original mastectomy operation. A flap for the central part of the thoracic wall may be obtained by mobilizing the tissues forming the medial portion of the opposite breast.

By completely mobilizing the breast on the opposite side at its lower margin, and to a considerable extent along both the axillary and medial borders, the breast can be displaced considerably and yet maintain an excellent blood supply through its upper and axillary attachment. The defect created by the displacement of the breast toward the opposite side of the anterior chest wall can readily be closed without tension by mobilization of the subcutaneous tissue in the lower axillary and upper abdominal areas. An additional incision may be required, to permit a satisfactory advancing of these latter flaps.

The tissue of the anterior abdominal wall, with a pedicle laterally, may be utilized for defects in the lower anterior thoracic region, and pedicle flaps from the axillary region may be used for the closure of defects in the lateral portion of the thoracic wall. If intensive radiation therapy followed the original radical mastectomy, the situation is more complicated.

Resection of a tumor of the chest wall often requires removal of the ribs, intercostal structures, and parietal pleura en masse over a considerable area.

Any repair of the thoracic wall which does not employ bony structures or periosteum from which bone can regenerate fails to give an ideal result. Permanent paradoxical motion with respiration, bulging on coughing or straining may be noted. Therefore, whenever possible, periosteum or segments of rib or cartilage should be used in the closure of the defect. The employment of a foreign body such as tantalum plate has been unsatisfactory because proper anchorage and imbedding has not proved feasible. It is difficult to immobilize the metal plate in a moving chest wall.

The most satisfactory repair of average sized defects was obtained by using a periosteal flap developed from ribs immediately above and below the margin of the hernial orifice. In some cases ribs at the margin of the defect were cut tangentially, and then displaced upward or downward and fixed to the rib stump of an adjacent partly resected rib. These displaced ribs helped to narrow the defect, and the periosteum from these ribs could be sutured to one another to further lessen the space. These maneuvers, however, could not be employed in some of the huge defects that were encountered, and in such cases a closure which does not have the stability of the normal thoracic cage was obtained. If a large defect of the entire thickness of the thoracic wall was present, combined with an empyema, a combination of thoracoplasty and the use of a full thickness flap of the chest wall was employed. A defect over the precordium was closed by making an intercostal incision through the full thickness of the chest wall lateral to the defect at its upper and lower margins. Because the paravertebral portion of the ribs of this area had previously been removed subperiosteally, it was possible to slide this full thickness flap

over the precordium and hold it in place by sutures to the sternum. Because such a flap contains periosteum, later bone regeneration can occur and the chest wall may become firm in contrast to the flaccidity of the chest wall when only a flap of soft tissue is employed. STEPHEN A. ZIEMAN, M.D.

Hormonal Alteration of Advanced Cancer of the Breast. IRA T. NATHANSON. *Surg. Clin. N. America*, 1947, 27: 1144.

Evidence is presented showing the relation and effect of hormones on cancer of the breast.

Beneficial responses have been obtained following estrogen therapy on the soft tissue manifestations of breast cancer, primarily in elderly women. Androgens, on the other hand, may favorably influence osseous metastases in women of any age. Castration may affect osseous metastases in premenopausal women and most manifestations of the disease in older men. These responses are only temporary as reactivation is the rule.

The administration of sex hormones or castration in carefully selected patients may be of value as a palliative measure when other methods are not feasible, or as an adjunct to the orthodox procedures.

The studies indicate that breast cancer may be dependent upon the endocrine status of the host. It appears, therefore, that the validity of the classic concept of autonomy of cancer cells must be questioned. The fact that alterations occur in breast cancer following sex hormonal administration or deprivation should lead to intensive investigation regarding the mechanism involved. If this is kept foremost in mind, rather than the possibility that hormones may be a means of cancer therapy, progress can be expected. STEPHEN A. ZIEMAN, M.D.

TRACHEA, LUNGS, AND PLEURA

A Study of Variations of the Bronchopulmonary Segments in the Left Upper Lobe. J. GORDON SCANNELL. *J. Thorac. Surg.*, 1947, 16: 530.

The left upper lobe bronchus usually bifurcates into a superior and an inferior (lingular) division (Fig. 1). The upper division then divides into an anterior (B^2) and an apical-posterior segmental bronchus (B^1 and B^3). The anterior branch (B^2) usually divides into a posterior ramus (B^2_a) which reaches the interlobar fissure and adjacent costal surface, and an anterior ramus (B^2_b) which supplies the more anterior costal and mediastinal surfaces. The apical posterior bronchus (B^1 and B^3) subdivides into an apical subsegmental bronchus (B^1) and a posterior subsegmental bronchus (B^3). The lingular division has two components, a superior (B^4) and an inferior (B_5) segmental bronchus.

The principal variation in the left upper lobe centers about the development of an accessory anterior bronchus (BX^2_b) which is usually accompanied by a downward displacement of the anterior segmental bronchus (B^2), so that a pattern approaching a trifurcation of the left upper lobe bronchus is

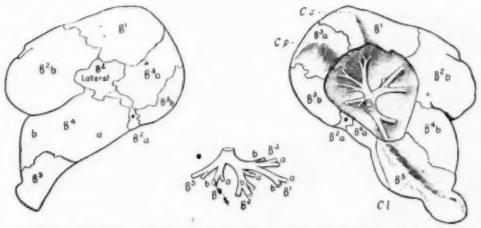

Fig. 1 (Scannell). Injected specimen (No. 1) demonstrating prevailing pattern in series described by Boyden and Hartmann. Costal surface on left, mediastinal view of bronchial tree in center, medial surface on right. B^2_a failed to fill with the injection mass and is indicated by an asterisk. *C.i.*, frenum (or lingular crest), *C.p.*, posterior crest, *C.s.*, subclavian crest.

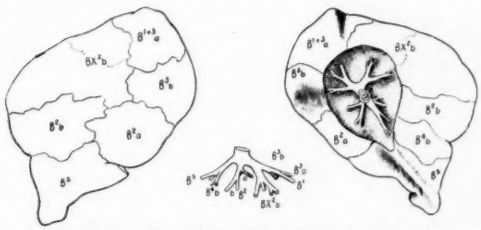

Fig. 2. Injected specimen (No. 18) depicting trifurcate branching of upper lobe bronchus caused by downward displacement of anterior segmental bronchus, B^2, which then forms central limb of trifurcation; an accessory bronchus, BX^2_b, has appeared to take over area "vacated" by B^2_b. Superior lingular bronchus, B^4, is incomplete since its posterior ramus is absent and it lacks representation on costal surface. B^1 and B^3_a were not injected separately in this specimen.

presented (Fig. 4). Variations in composition of the "axillary" area of the left upper lobe are centered about the posterior ramus of the anterior segmental bronchus (B^2_a). This posterior ramus is often absent, and the defect is remedied by compensatory expansion of the adjacent subsegments (B^3_b and B^4_a), or by the appearance of an accessory branch (BX^2_a). In the majority of instances of an absent B^2_a, branches of the posterior segment (B^3_b) and superior lingular segment (B^4_a) supply the area involved.

In the series of 13 specimens studied, only one showed a posterior segment (B^3) extending upward to include the highest point of the lung. However, if the apex be considered as that portion of the lung lying above the plane of the first rib, then 4 of the 13 specimens showed the posterior segment entering into the apex. SAMUEL KAHN, M.D.

Intralobar Sequestration of the Lung Associated with an Abnormal Pulmonary Artery. D. M. PRYCE, T. HOLMES SELLORS, and L. G. BLAIR. *Brit. J. Surg.*, 1947, 35: 18.

This article describes certain abnormalities in the vascular supply and anatomy of the lung which the

surgeon may encounter at operation. Three types may be recognized: (1) abnormal artery to the normally connected lung, (2) abnormal artery to a sequestrated mass and adjacent normal lung, and (3) abnormal artery confined to the sequestrated mass.

In spite of their origin from the aorta, these abnormal arteries are not bronchial arteries. Bronchial arteries are small and muscular, but these vessels are large and have the elastic structure characteristic of pulmonary arteries. As the result of the higher blood pressure, these abnormal pulmonary arteries often show atherosclerotic changes.

The sequestration appears as a large cyst: a mass of polycystic lung connected with a dislocated blind bronchus at the hilum or a mass of lung with bronchi branching parallel with the abnormal artery.

Inflammatory changes occur and vary greatly, and the clinical symptoms are all referable to infection which usually began early in life.

Diagnosis is difficult and usually a neoplasm is suspected. Roentgenography is of practical help.

The condition may be recognized at operation, which is usually undertaken for supposed bronchiectasis, cystic disease, or empyema. Occasionally the condition is only identified on pathologic examination. Surgical excision is the appropriate treatment in view of the tendency toward infection.

The abnormality is obviously related to a lower accessory lung which may come from an extra lung bed or is a detached part of the developing lung. The sequestration may be complete or partial. The condition shows a preponderant tendency to occur on the left side, probably being associated with the bulging of the heart to that side.

The authors report 8 cases, narrating the history and course of this complex congenital condition.

STEPHEN A. ZIEMAN, M.D.

Experience with Thoracic and Thoracoabdominal Wounds in an Evacuation Hospital. S. A. MACKLER. *J. Thorac. Surg.*, 1947, 16: 538.

Patients with wounds of the chest may be divided into 2 groups: those that require thoracotomy and those that do not. Of 285 patients with penetrating and perforating wounds of the thorax, 65 required thoracotomy. The indications for thoracotomy, in the order of frequency with which they occurred, are: (1) the anatomic likelihood of diaphragmatic penetration; (2) the presence of large intrapulmonary and intrapleural foreign bodies; (3) the presence of missiles in, or traversing, the mediastinum; (4) wounds of the large bronchi; and (5) continuing intrapleural hemorrhage.

Thirty-five of the 65 patients in whom thoracotomy was done required, in addition, exploration of the peritoneal cavity through the diaphragm. There were 5 deaths in this group of 65 patients, a mortality of 7.7 per cent.

Two hundred and twenty patients did not require thoracotomy. The general management of these wounds consisted of débridement, the prevention of sucking by suturing the breach in the thoracic wall, and the evacuation of blood and air from the pleural cavity to obtain early expansion of the lung. Ten of these patients died, a mortality of 4.5 per cent.

Preoperative and postoperative care was directed toward the achievement of three basic aims: the restoration of respiratory equilibrium, the restoration of circulatory equilibrium, and the prevention of infection.

Respiratory distress was corrected by the maintenance of a clear tracheobronchial tree and by expansion of the lung by repeated thoracentesis whenever necessary. The use of oxygen as an adjunct in the treatment was routine.

Circulatory imbalance was treated by the administration of citrated whole blood in an amount sufficient to give an adequate response. It was not unusual to administer from 1,000 to 1,500 cubic centimeters.

The factor of greatest importance in the prevention of infection during the postoperative period was the early obliteration of the pleural space by an expanded lung. This was achieved by repeated thoracentesis. Penicillin was given intramuscularly in the amount of 25,000 units every 3 hours. This was begun on admission and continued until the lung was completely expanded. SAMUEL KAHN, M.D.

Traumatic Rupture of the Bronchus. THOMAS J. KINSELLA and L. W. JOHNSRUD. *J. Thorac. Surg.*, 1947, 16: 571.

Traumatic rupture of the bronchus occurs very rarely, and is recognized clinically with even less frequency. At least 38 cases have been reported in the literature, and 2 cases are added by the authors. The history in most cases is the same. The patients sustain a severe chest injury of a compression or crushing type, the ribs may not be fractured, and hemoptysis may not occur. Shock is usually profound. Marked dyspnea and cyanosis may develop if a tension pneumothorax occurs; hemothorax and subcutaneous emphysema may appear. The condition occurs at all ages, usually in males.

The exact mechanism by which the lesion occurs is not always clear. Apparently, a severe shearing force is brought to bear upon the bronchus, causing it to rupture. The point most likely to tear is the main bronchus, within a few centimeters of the trachea. The right and left sides are involved with equal frequency. Rupture of the lung itself is not usually found in association with rupture of a bronchus, nor are the arteries and veins of the pulmonary hilum injured as often as would be expected.

Following the bronchial tear, a pneumothorax of varying extent develops in about 40 per cent of all cases. Complete or nearly complete bronchial occlusion occurs, with the development of a marked atelectasis of the involved lung, followed by an extremely marked shift of the heart and mediastinum toward the affected side, producing the dyspnea, chest discomfort, and other symptoms of which the patients subsequently complain. If the obstruction

is not complete, secondary bronchiectasis and inflammatory changes are likely to ensue.

The first therapeutic considerations should be the administration of oxygen to correct the anoxemia, the administration of blood and plasma to combat shock and hemorrhage, the aspiration of air from the pneumothorax side to relieve intrathoracic tension, and incision, if necessary, to relieve tension from mediastinal emphysema. If rib fractures are present, sedatives or novocain block may be found of distinct value.

Early bronchoscopy should be done if the patient's condition permits it. If blood clots are present, they should be removed in order to relieve atelectasis.

The condition may be amenable to surgical treatment. The risk of exploration may be slight as compared to the risk of doing nothing. The suture of an incompletely torn bronchus at the site most often affected should not prove to be too difficult. Even suture of a complete rupture of the bronchus, with the pulmonary and bronchial vessels intact, may also be possible. If a stricture results and the entire lung becomes atelectatic, a therapeutic pneumothorax on the affected side may relieve the symptoms and hold the mediastinal structures at or near the midline.

Patients who have an incomplete bronchial obstruction with infection will eventually develop bronchiectasis and infection in the lung distal to the stenosis. In such cases, pulmonary resection should be considered. Mediastinal shift, and overexpansion of the contralateral lung will be less following total pneumonectomy than from the atelectasis due to the bronchial stenosis, as the fluid and coagulant which fill the pleural space after pneumonectomy occupy more space than the atelectatic lung which has been removed.

SAMUEL KAHN, M.D.

Pneumonectomy for Chronic Suppurative Disease (Neumonectomia por sepsis cronica del pulmon). JUAN C. BIDART MALBRÁN and JORGE GALARCE. *Bol. Acad. argent. cir.*, 1947, 31: 572.

This article is principally a report of a chronic nontuberculous lung abscess treated successfully by pneumonectomy. It occurred in a 39 year old male, who gave a 6 months history of the disease and had failed to respond to conservative management.

An excavating neoplasm was suspected, of course, and thoracotomy carried out. The gross findings at operation were compatible with neoplasm and a pneumonectomy by individual ligation technique was performed.

The postoperative course in this case was complicated by extensive breakdown of the wound in the chest wall as a result of infection. It is anticipated that a thoracoplasty will be performed. No neopasm was found in the resected specimen. There was, instead, a suppurative process containing 2 well defined abscess cavities.

The justification for resection in chronic pulmonary suppuration is briefly discussed.

HIRAM T. LANGSTON, M.D.

Pulmonary Cysts, with Special Reference to Surgical Treatment of Emphysematous Blebs and Bullae. EMIL NACLERIO and LAZARO LANGER. *Surgery*, 1947, 22: 516

Although the precise mechanism of the genesis of pulmonary cysts is unknown, it is believed that they originate from some developmental anomaly. There are three probable origins: congenital bronchiectasis, dilatation of lymphangiomatous spaces, and aberrant lung tissue or vestigial structures.

The manner in which a bleb is formed is similar to that in which interstitial emphysema occurs. There is a rupture of the wall of an alveolus which allows air to escape into the alveolar layer of the pleura.

In the case of bullae, the alveoli are first dilated, then atrophy and rupture of the alveolar wall occur; various sized bullae gradually form, which communicate with a bronchiole or a larger division of the bronchial tree. When blebs are present, the pleura is separated by the air from the underlying alveolar walls. When bullae occur, the pleura retains its connection with the lung, although the alveoli beneath them produce the bullae through rupture and fusion. The bullae can be considered best as an advanced stage of a localized pulmonary emphysema.

Since blebs and bullae are often associated with marked emphysema, the clinical picture may be that of the latter condition only. The symptoms depend on the size, location, valvular mechanism, and condition of the contiguous lung parenchyma, and changes that may occur in the intrathoracic pressure. Infection is rarely seen in blebs and bullae, although cysts of other types are prone to infection and produce symptoms of pulmonary suppuration. Blebs and bullae may remain symptomless for long periods, and become distressing only when they are very large. Dyspnea may then become a prominent symptom, and cough, expectoration, and pain in the chest may appear. Occasionally, a spontaneous pneumothorax may result from the rupture of a bleb or bulla.

Pulmonary blebs and bullae, even when large, may be asymptomatic, and may be discovered only on x-ray examination. They often disappear spontaneously. When severe and incapacitating respiratory symptoms appear, operative procedure may be necessary.

Ten cases are reported, 5 of pulmonary emphysematous cysts, 3 of bullae, 1 of bleb, and 1 of chronic interstitial emphysema involving the entire left lower lobe, and the surgical procedure used in excising the involved area is described.

SAMUEL KAHN, M.D.

Malignant Lymphoma of the Lung and Pulmonary Coccidioidomycosis. EDWARD D. CHURCHILL. *Surg. Clin. N. America*, 1947, 27: 1113.

Churchill reports a successful operative case of malignant lymphoma of the lung in a 45-year-old woman whose only complaint was aching pains in the right shoulder for over 20 years. Objective symptoms revealed little, and only after careful x-ray

studies was the lesion in the upper right lobe of the lung considered operative. Because the middle lobe was fused with the upper lobe the two parts were removed after separate ligation and division of the hilar structures.

Roentgen therapy was instituted early. The patient made an uneventful recovery and is living with no evidence of the disease 6 months after operation.

A second case discussed was that of a 14-year-old boy with a baffling lesion in the upper left chest. After conservative methods failed, surgery was undertaken. An immediate frozen section revealed a chronic inflammation, probably coccidioidomycosis. The entire left lung, with exception of the lingula was removed. After operation, coccidioides were found in the sputum; previously they had had no free access to the bronchus as the whole upper lobe, on pathologic sectioning, showed consolidation with only a few lung markings remaining.

STEPHEN A. ZIEMAN, M.D.

Primary Cancer of the Lung. ALTON OCHSNER, MICHAEL DEBAKEY, and J. LEONARD DIXON. *J. Am. M. Ass.*, 1947, 135: 321.

Within the past few decades two well established and generally accepted concepts of primary cancer of the lung have been completely disproved. One is the concept that carcinoma of the lung represents the rarest form of cancer. It now appears that lung cancer is one of the most frequently encountered neoplasms, being preceded only by cancer of the stomach. The other and more important concept disproved is that pulmonary cancer is a hopeless condition.

This is a review of 412 cases of cancer of the lung observed at Tulane University School of Medicine service in the Charity Hospital of Louisiana at New Orleans and in private practice at the Ochsner Clinic over a period of approximately 12 years. Of the 412 patients, 246 underwent surgical exploration and of the 246, 147 were subjected to primary pulmonary resection. An analysis of the experience with these patients with particular emphasis on the follow-up study on all patients who were submitted to primary resection is given. (This is essentially the same data, with 18 added resected cases, as that presented by Ochsner, DeBakey, and Dixon in the *Annals of Surgery* (1947, 125: 522) and abstracted in INTERNATIONAL ABSTRACTS (1947, 85: 459).

Thirteen and six-tenths per cent of the cancers occurred in women and 86.4 per cent in men. The fifth, sixth, and seventh decades were the most frequent time of appearance of the carcinoma. The etiology is obscure, and both occupation and smoking, previously particularly emphasized, were found to have no special significance in this analysis.

The most common early symptom is cough, which is significant when any change in type of cough occurs and the change persists, particularly over a period of more than 3 or 4 weeks. Physical observations are extremely variable and depend upon the location of the carcinoma.

The most important factor in diagnosis is the consideration of the possible presence of cancer. Primary cancer of the bronchus should be suspected in every person over 40 years of age who has unexplained thoracic discomfort, a persistent cough, or hemoptysis. This is the key to increasing early diagnosis. Abscesses of the lung which cannot be satisfactorily explained in any man past 40 should be considered carcinoma until disproved. (The diagnosis of pulmonary abscess was the most frequent error encountered—5.4%.)

Roentgenographic examination is accurate initially in 82.3 per cent of the cases. Bronchoscopic examination with biopsy is the most accurate with positive diagnoses in 82.4 per cent of 74 cases in which biopsy was obtained among the 125 cases subjected to bronchoscopy. Thus, a positive diagnosis was obtained by bronchoscopic biopsy in 41.5 per cent of 147 cases.

The lesion is located in the upper lobe in 49 per cent of the cases. Cytologic examination is particularly adapted to the verification of tumors in this location. Aspiration biopsy is condemned on the basis that implantation may occur along the site of the aspirating needle and thus preclude cure of the carcinoma. Exploratory operation should always be carried out for any unexplained thoracic complaint in a man past 40 years of age in whom the existence of bronchogenic neoplasm cannot be otherwise disproved or verified.

Extirpation of the tumor offers the only chance of cure. Pneumonectomy is the procedure of choice. The anterior approach is preferred.

The data indicate that for every 3 cases of pulmonary cancer, 2 will appear to be operable and only 1 case will prove to be resectable. Both operability and survival rates are improving when statistics made prior to 1942 are compared with those made after 1942. The hospital mortality prior to 1942 was 46.4 per cent; it is now 19.3 per cent. Hospitalization has decreased from 32.3 days prior to 1942 to 13.5 days since 1942. Cardiovascular lesions account for 47 per cent of the hospital fatalities.

Survival rates drop rather rapidly within the first 2 postoperative years but by the third year become stabilized and continue almost as a plateau until the fifth year. This means that the five year survival of approximately one-fourth of the patients (23.3%) is approximately that of the 2 year survival rate.

A summary of operability and survival rates for all carcinomas of the lung according to these statistics would mean that 60 per cent of the patients meet the criteria for operability; 36 per cent would prove resectable; 28 per cent would survive the operation; and 8 per cent would survive 5 years or longer.

The need for earlier diagnosis is readily seen if one reflects that should all cases be resectable when first seen, then on the basis of present performance 20 per cent of the patients with carcinoma of the lung might be expected to survive 5 years or longer.

FRANK B. QUEEN, M.D.

Induction of Bronchogenic Carcinomas in Mice. E. S. HORNING. *Lancet*, Lond., 1947, 2: 207.

The author presents a preliminary report in which he describes the technique of inducing tumors by the direct application of carcinogenic compounds, sometimes in combination with synthetic hormones, to adult lung tissue growing as homologous grafts in host animals.

Small pieces of adult lung are isolated under a dissecting microscope and impregnated with a few crystals of 20—methylcholanthrene. On placing the carcinogen in direct contact with the tissue to be grafted, care is taken to wrap the tissue around the crystals so that they are shielded from contact with the tissues of the host. The grafts are implanted subcutaneously, with a Bashford transplanting needle, on each side of the belly of the host. As many as six subcutaneous primary grafts have been made in a single mouse. In all cases the graft tissue was taken from mice, aged 3 months, belonging to the same strain as the hosts in which the grafts were to be implanted.

The host mice, bearing lung grafts, were mice of strains A and C3H which received lung implants impregnated with methylcholanthrene and were killed after an interval of 6 to 8 weeks, before malignant tumors had developed. The grafts were fixed for histologic study of early phases of carcinogenesis.

The pulmonary tumors were induced in both male and female mice, the incidence being about equal in the two sexes. The malignancy of the tumors was proved in all cases by transplanting portions of the primary tumor into mice of the same strain. All the transplants grew, and some of these tumors are now in the third and fourth generations of transplantation. Grafts which did not develop tumors had become necrotic, presumably because of failure of vascularization.

In mice of strain C3H the tumor incidence was increased if the lung grafts were impregnated with stilbestrol in addition to the carcinogen.

The several advantages in this method of tumor induction are that the carcinogen is placed in direct contact with the living cells of the graft, without the use of a solvent, and therefore there is little or no foreign-body reaction, or residue of necrosis, which might mask or conceal areas in which neoplastic changes first arise. Since the focus of activity of the carcinogen is within a graft and not in some part of a large organ, the growth of the affected tissues may be more readily observed macroscopically and more easily removed for histologic examination of the early stages. The neoplasms arise in subcutaneous grafts and are maintained by subcutaneous transplantation. A series of grafts established in one host can be regarded as growing under identical hormonal conditions. STEPHEN A. ZIEMAN, M.D.

Bronchiogenic Carcinoma. VIKING OLOV BJÖRK. *Acta chir. scand.*, 1947, 95: Supp. 123.

The author presents an admirable summary of facts obtained from an analysis of 345 cases of clinically diagnosed bronchogenic carcinoma. The patients were treated at the Brompton Hospital for Diseases of the Chest, and at the Royal Cancer Hospital (Free), in London, during the period from 1937 to 1946.

The clinical findings were as follows: 90 per cent of patients were males and 10 per cent were females; 98.3 per cent of the patients were 30 years of age or over; 87.8 per cent were 40 years or over, the peak being from 50 to 54 years; 58.8 per cent of the lesions were located in the upper lobe and 38.4 per cent in the lower lobe. In 53.2 per cent of the cases there was a slight right predominance which corresponds to the normal values of weight and volume determination in which the right lung represents from 53 to 54 per cent. Pathological analyses were: squamous cell carcinoma, 50.2 per cent; oat cell carcinoma, 24 per cent; undifferentiated carcinoma, 15.7 per cent; adenocarcinoma, 9.2 per cent; and mixed adenocarcinoma and squamous cell carcinoma, 0.9 per cent.

The anatomic classification of these tumors is as follows: central tumors, 65 per cent; intermediate tumors, 23 per cent; peripheral tumors, 12 per cent. No relation was observed between the histology and (a) localization, (b) duration of symptoms, (c) time of appearance of metastases or method of spread.

In women, a relative predominance of adenocarcinoma (25%) was observed as compared to a 9.2 per cent incidence of all bronchogenic cancers in both men and women.

The most important symptom was a dry, persistent cough lasting for a period of more than 4 weeks. Hemoptysis or pain, both relatively late symptoms, bring the patient to the doctor.

The methods of diagnosis were as follows: biopsy by bronchoscopy was done in 59 per cent of the cases; thoracotomy was carried out in 17 per cent, lymph node biopsy in 10 per cent, autopsy in 6 per cent, examination of sputum in 4.7 per cent of the cases; miscellaneous methods were used in 3.4 per cent. A total of 7.5 per cent of the tumors were operable (operability has been increased to 13.5 per cent since 1944). Operation could be completed in 49 per cent of the patients on whom thoracotomy was performed. Widening of the carina is not considered a contraindication to exploration, since this may be occasioned by inflammatory enlargement of the lymph nodes at the bifurcation and may not be due to metastases. Only 21 per cent of enlarged hilar nodes were due to metastases; 79 per cent were purely inflammatory. Pneumonectomy, with use of the dissection technique and closure of the bronchus by one row of isolated subterminal linen sutures and one continuous linen suture with a pleural flap is the operation of choice except in rare instances in which lobectomy is desirable for palliative reasons. Chemotherapy is used 2 days before and 1 week after operation. Preoperative pneumothorax is not useful.

In the present series the hospital mortality was 30 per cent. The primary mortality following the last 25 pneumonectomies was 8 per cent.

Of all patients operated upon and followed up (79), 5 per cent are alive longer than 5 years, 16 per cent are alive longer than 3 years, 23 per cent, longer than 2 years, 39 per cent, longer than 1 year. The histologic differentiation of the cancer has no influence upon survival.

All inoperable tumors without contraindication should be treated by deep x-rays. One 5 year survival has thus been secured. Untreated patients with carcinoma of the lung do not survive longer than 1 year after diagnosis. Contraindications to deep x-ray treatment consist of poor general condition, extrathoracic metastases, large (but not small) pleural effusions, and well defined rounded tumor.

Postoperative deep x-ray therapy is of value only in cases in which it is possible to exactly localize the area for treatment.

Deep therapy consists of 4,000 roentgens, or more, delivered through multiple small x-ray fields applied from two opposing parallel planes on either side of the thorax with 4 fields applied to each plane each day, the position of the field being changed to an intermediate position on alternate days. By this means, 250 per cent to 300 per cent of the dose given to any point of the skin may be delivered to the bronchial carcinoma. Ninety-two patients were so treated (excluding those in stage 4 with extrathoracic metastases). Complete relief of symptoms was obtained in 11 per cent, there was improvement in 46 per cent, no change in 19 per cent, and the condition became worse in 24 per cent.

This article contains the best factual summation of information on pulmonary carcinoma which this reviewer has encountered to date.

FRANK B. QUEEN, M.D.

Pulmonary Function after Pneumonectomy and Lobectomy. G. BIRATH, C. CRAFOORD, and P. RUDSTRÖM. *J. Thorac. Surg.*, 1947, 16: 492

Following pneumonectomy, the total lung volume is somewhat less reduced than would be expected from the corresponding loss of parenchyma. In the position of maximum inspiration, the remaining lung tissue is, therefore, exposed to increased distension. The distension of the lung tissue is especially marked in the respiratory midposition, for, in the equilibrium position, the lung volume is approximately 50 per cent greater after pneumonectomy than can be expected from calculation.

After pneumonectomy and lobectomy, the share of the residual and equilibrium capacities in the total capacity is clearly increased. This indicates a reduction of the respiratory efficiency. There occurs also an increase in the respiratory dead space, due, probably, to the increased lung inflation and, to a certain extent, to emphysema.

Postoperatively, dyspnea steadily diminishes and causes very little difficulty. If, after lobectomy and pneumonectomy, emphysema develops in the course of years, it appears to remain within moderate limits and not to encroach upon the lung function to any important degree. SAMUEL KAHN, M.D.

Empyema Thoracis in Infants and Children. ALFRED E. CHAPLIN. *Arch. Dis. Childh.*, Lond., 1947, 22: 91.

A study of empyema thoracis in infants and children, covering two 5 year periods (1934–1938 and 1940–1944), was undertaken with a view of comparing the effect of sulfonamide therapy upon the incidence of the disease. A third group of cases consisting of 21 infants treated with penicillin since 1945 is discussed, to illustrate the progress which has been made in the management of the disease in a most susceptible age group—the first 2 years of life.

During the period from 1934 to 1945 the author observed a reduction in the incidence of pneumococcal and streptococcal empyema in children and infants, and a reduced incidence of staphylococcal empyema in children of 2 to 14 years. Little or no reduction was observed in the number of cases of empyema or in the mortality figures for children from 0 to 2 years of age. Staphylococcal infections were observed as frequently as pneumococcal infections, if not slightly more frequently, in the group from 0 to 2 years of age. The average mortality rate for all bacterial types of infection was 64 per cent for children 0 to 2 years of age.

It was concluded that penicillin plays an important part in the treatment of acute empyemas due to sensitive organisms. Penicillin may be injected parenterally and intrapleurally, with aspiration of the pleural pus. Instillation of an adequate dose of penicillin every 2 to 3 days may produce complete resolution of the empyema in infants up to 1 year of age. From 1 year onwards, however, success with treatment by this method is unlikely unless the empyema is small. Aspirations are controlled by frequent radiographic examinations. Should the patient be slow to respond, and in the event of development of a thickened pleura, surgical drainage is indicated. Similar interference is indicated in cases in which fibrin in the pus prevents adequate removal by aspiration. The intrapleural injection of penicillin should produce sterility of the pleural sac after one or two aspirations.

Rapid recovery with shortened convalescence occurred in both groups of infants—i.e., with and without surgical drainage.

STEPHEN A. ZIEMAN, M.D.

Discussion on Treatment of Nontuberculous Empyema. R. C. BROCK, and T. HOLMES SELLORS. *Proc. R. Soc. M., Lond.*, 1947, 40: 645.

This article is a continuous discussion of nontuberculous empyema by two authorities. Brock considers an empyema as a localized collection of pus in the pleura, and a mature abscess as the end result of an acute suppurative process. The fundamental treatment of the empyema is reduced to 4 points: (a) assessment of the correct time for drainage, (b) provision of adequate drainage, (c) institution of proper physical treatment, and (d) decision as to the correct time to stop drainage.

Perhaps the most important thing we have learned in chest surgery from the war is that great success

can follow early evacuation of the clot and decortication of the lung in an infected hemothorax. A patient gravely ill with a chest full of infected clot which is breaking down, and often with a heavy mixed and foul anaerobic infection, either dies or drifts into chronicity if treated by aspiration or by drainage alone. If treated by open thoracotomy and decortication of the lung, and if the expansion of the lung is maintained by continuous pleural suction, these patients get well, can be completely healed in 2 or 3 weeks, and are left with a virtually normal chest. The operation is a severe one but is well tolerated if performed with simultaneous blood transfusion.

Sellors brings out the fact that chemotherapy can achieve good results. It is realized that chemotherapy, particularly penicillin therapy, can achieve good results in diffuse and early infection, but its use in a local pleural abscess is open to definite limitation. Penicillin can certainly sterilize many of these abscesses, but it cannot obliterate the actual cavity, and persistence of the cavity beyond a certain stage increases the liability to formation of a chronic thick walled dead space. Sellors then discusses the method of closure of the empyema cavity after drainage, maintaining that 2 factors will prevent chronic empyema: (1) the maintenance of adequate drainage until the cavity is obliterated, and (2) breathing exercises and physical treatment to restore respiratory function and to encourage the lung to re-expand. STEPHEN A. ZIEMAN, M.D.

HEART AND PERICARDIUM

Studies of Cardiac Disturbances in Cases of Healed Traumatic Chronic Empyema of the Pleura. JAAKKO S. AALTO. *Ann. chir. gyn. fenn.*, 1947, 36: Supp. 2.

The aim of this investigation was to clarify the importance of the cardiac disturbances in the degree of disability following chronic empyema cavities caused by war injuries. An endeavor has been made to find an answer to the following questions:

Is there a disturbed heart function, and what is its extent, in cases of healed traumatic chronic empyema?

To what degree is the disturbed function of the heart caused by intracardiac, and by extracardiac factors?

Which intracardiac and extracardiac factors are the most important in this respect?

Are the disturbances in the function of the heart severe or slight, and what is their prognostic significance?

In what way is the incidence of these disturbances affected by the duration of the primary disease and by the size and location of the empyema cavity?

The material comprises 58 cases, all males aged 20 to 49 years. Prior to being wounded, none of them showed symptoms of heart disease. As a result of war wounds, 19 patients had a total chronic empyema, 37 patients had a small or moderate sized cavity limited to the lower, or lower and middle, part of the pleura and 2 patients had a small or moderate sized cavity in the upper part of the pleura. The cavity was on the left side in 31 patients and on the right in 27. All patients were treated surgically, the most frequent intervention being an extrapleural or intrapleural thoracoplasty, often combined, or supplemented by myoplastic operations of varying type, and once by decortication of the visceral pleura. The primary disease and its treatment have left more or less extensive deformities in the chest, scoliosis of the vertebral column, pleural adhesions, rigidity and abnormal positions of the diaphragm, displacement of the mediastinum and its organs, pulmonary hernias, and paralysis of the upper abdominal muscles.

The follow-up examinations in the different cases took place after periods of 1 month to 4 years had elapsed from the time of healing of the chronic empyema cavity. Two patients were examined 3 times, 25 were examined twice and 31, once. The follow-up examinations of the same patients were generally 6 months apart. Taking all examinations in the different cases into account, the number of follow-ups was 41 in the first year after healing, 21 in the second, 15 in the third, and 10 in the fourth year.

Besides an ordinary clinical examination, the subjects were submitted to the following special tests: the pulse rate, arterial pressure, vital capacity, venous pressure, and circulation time were observed during rest and after exercise. Special attention was paid to the electrocardiographic alterations during rest and at given intervals after exercise.

Although, after the healing of the primary disease, the majority of the patients showed subjective symptoms pointing to cardiac disorders, disturbed function of the heart could not be ascertained in any of the patients by means of ordinary clinical examinations. The pulse rate, arterial pressure, vital capacity, venous pressure, and circulation time, determined during rest and after exercise, corresponded with that of healthy individuals in at least four-fifths of the cases. At the later follow-up examinations, a decrease in the number of abnormal results was generally observed. As these results may be directly influenced by many extracardiac factors (and this was true in the present series) greater significance must be attached to the normal findings than to those diverging from the normal when evaluating the function of the heart. In all of the cases several of the 5 functional tests, and in more than one-third of the cases all 5 tests, suggested a normal cardiac function. Definite conclusions cannot thus be drawn as to the presence of disturbed heart function on the basis of these tests. In view of the fact that results may be directly influenced by extracardiac factors, the results should be considered indicative of the general ability of the organism which is conditioned by several factors—in the first place by the state of the nervous system, the respiratory tract, and the circulatory system. At successive examinations the

results in the cases studied showed the direction of development of the regenerative phenomena in the pathoanatomical and physiopathological changes.

Electrocardiographic abnormalities are not generally caused directly by extracardiac factors, but arise as a result of disturbed cardiac function. For that reason, the chief conclusions in the present investigation must be based on changes in the electrocardiogram. In addition, the electrocardiogram, particularly after exercise, often indicates the cause of the functional disorder; it does not, however, reveal the degree of the disturbance as a rule. Ordinary clinical examinations may, to some extent, support the electrocardiographic studies regarding the causes and degree of the functional disturbances. On the basis of the pulse rate, arterial pressure, vital capacity, venous pressure, and circulation time, conclusions may, however, be drawn only regarding the degree of the disorder.

In 24 of 58 cases electrocardiographic abnormalities indicated the presence of a disturbed function of the heart; in 14 cases the alterations were attributed to intracardiac factors; in 7 cases it was impossible to establish whether the causes were intracardiac or extracardiac; and in 3 cases the symptoms suggested extracardiac factors.

The studies justify the assumption that the intracardiac causes of disturbed function of the heart are chiefly infectious, infectious-toxic, or anoxic changes in the myocardium. The changes caused by the infection arise principally via the blood stream, although a direct infection via the pericardium is also possible. A deficient oxygen supply to the myocardium may be due to anoxemia, possibly caused by pathoanatomical and physiopathological changes in the chest and its organs, or to a decrease in the cardiac output which, particularly in a part of the myocardium which is overburdened or has undergone myocarditic changes, may easily result in anoxic changes. An overload on the right heart due to possible hypertension in the ordinary pulmonary circulation is then chiefly to be considered, as nothing has been noted at the examinations to indicate valvular disease. On the other hand, a myocardium with deficient oxygen supply or an overburdened myocardium may be exceptionally susceptible to infective processes. It seems that in the cases in which the disturbed function has been attributed to intracardiac causes, myocarditic lesions, either alone or in association with anoxic myocardial injuries, are perhaps the most frequent. Extracardiac causes of functional heart disorders are especially those factors which cause a deficient oxygen supply to the myocardium and have not been sufficiently strong or long-standing to cause myocardial lesions. Another factor to be considered in particular is the exceptionally great lability of the nervous system in the present series of cases.

Decompensation was not observed in any of the cases. Routine clinical examination did not even reveal distinct symptoms of compensated heart disease. The functional heart tests showed that the functional disorders were slight; the tests also indicated that certain extracardiac causes of disturbed heart function decrease in the course of time. However, definite conclusions regarding the prognosis can be drawn only by studying the cases closely over a long period of time.

The duration of the primary disease does not appear to influence the frequency of disturbed cardiac function. It is decidedly higher in cases in which the chronic empyema cavity has been larger than in cases in which the cavity has been small. The incidence of disturbed cardiac function is similarly higher if the cavity has been on the left side rather than on the right. JOHN J. MALONEY, M.D.

ESOPHAGUS AND MEDIASTINUM

The Sclerosing Therapy of Esophageal Varices. CECIL O. PATTERSON and MILFORD O. ROUSE. *Gastroenterology*, 1947, 9: 391

Over a 4 year period, 24 patients (26 were seen but 2 refused sclerosing therapy) have been treated for recurrent massive hematemesis by the injection of a sclerosing solution in the esophageal varices at esophagoscopy. The subjects ranged in age from 3 to 66 years.

These 24 patients had a total of 76 esophagoscopies with 209 injected sites receiving a total of 600 c.c. of 5 per cent sodium morrhuate. The average total injection per patient was 25 c.c., approximately 3 c.c. per varix punctured; the minimum was ½ c.c. and the maximum 14 c.c.

The incidence of episodes of hemorrhage would appear to have been significantly reduced as a result of the therapy based on a pre-injection incidence of bleeding. Of the 24 patients treated, 9 have died. Of the 9 who died, 6 had hematemesis as a part of the terminal picture. The other 3 died of other causes without recurrence of hemorrhage.

Of the 10 patients under 40 years of age who had had splenectomy and were given sclerosing therapy, 1 died. Of 8 patients under 28 years of age who survived splenectomy and had sclerosing therapy, none died.

Fifteen of the patients treated were considered to have a cirrhotic liver, 9 were believed to present Banti's syndrome and 8 of these had had splenectomy. The ninth patient has been advised to submit to splenectomy. Such corrective surgical treatment is considered necessary to the best results from sclerosing therapy. HIRAM T. LANGSTON, M.D.

Gastroesophageal Resection and Total Gastrectomy in the Treatment of Bleeding Varicose Veins in Banti's Syndrome. DALLAS B. PHEMISTER and ELEANOR M. HUMPHREYS. *Ann. Surg.*, 1947, 126: 397.

Splenectomy, portacaval shunt and injection of esophageal varices with sclerosing solutions have been the most reliable methods of controlling esophagogastric bleeding in Banti's syndrome. Splenectomy may fail to control the situation ultimately as

portal hypertension recurs. Portacaval shunt is not possible in certain situations, and, even when performed, the stoma may narrow or close. The injection of sclerosing solutions has not been uniformly successful. Resection of the bleeding segment is another approach to management which, even though it may throw an additional load on the remaining collateral routes, may be justified because these segments either do not bleed at all or they bleed infrequently.

The detailed reports of 2 cases in which this approach in management was utilized are given. The first case had frequent severe hemorrhages from gastric varices after splenectomy and extensive obliteration of esophageal varices by injections. The liver was considered normal. Total gastrectomy was performed 2¾ years ago. Only two attacks of hemorrhage have been experienced since, one moderate and one slight in extent.

The second patient is free from bleeding 3½ months following a transthoracic esophagogastric resection performed for severe hemorrhage, which had continued after splenectomy.

The study of the surgical specimen emphasizes the importance of gastric varices as a source of bleeding in addition to those present in the esophagus. The reports of these 2 cases are documented by numerous photomicrographs.

HIRAM T. LANGSTON, M.D.

Carcinoma of Esophagus. RICHARD H. SWEET. *J. Am. M. Ass.*, 1947, 135: 485.

The author appraises the immediate and late results of resection and primary esophagogastric anastomosis for carcinoma of the esophagus or cardiac end of the stomach, at the Massachusetts General Hospital, Boston, since it was first performed in 1939. There were 213 cases in the series, and 66.2 per cent of the lesions were considered resectable. These figures include the resectability rate for carcinoma of the midthoracic esophagus as well as of the cardia and lower esophagus. There were 72 patients with midthoracic lesions, 50 of whom were operated upon, and 141 patients with lesions of the cardia and lower esophagus, 91 of whom were subjected to resection. Seventy-nine of these latter patients survived the operation, 30 living for periods of from 6 months to 7 years, whereas of the 50 patients with midthoracic lesions who were operated upon, 39 lived for periods of from 6 months to 3 years.

The principal complications encountered after resection were infection, mediastinitis, cardiac, pulmonary and vascular disorders, and these rated high in the causes of death.

Dysphagia is the most distressing symptom of the disease, and operation is considered the most effective single procedure in alleviating this pathetic disturbance. This, in the opinion of the author, and the fact that recurrence at the anastomotic stoma seldom develops, thus giving the patient comfort for from 6 months to 2 years, make the operation worthwhile.

STEPHEN A. ZIEMAN, M.D.

Further Observations on Post-Tracheotomy, Mediastinal Emphysema, and Pneumothorax. GILBERT B. FORBES, GEORGE SALMON, and JOHN C. HERWEG. *J. Pediat.*, St. Louis, 1947, 31: 172.

The authors report their observations following tracheotomy in 120 children. Sixty-eight per cent of the children were under 2 years of age, 22 per cent were from 2 to 5 years old, and 10 per cent were from 5 to 10 years old. They were carefully studied for signs and symptoms of mediastinal emphysema and pneumothorax. Seventy-four of the children were examined roentgenographically.

Twenty-five per cent of all children developed mediastinal emphysema and 10 per cent developed pneumothorax. Since the incidence of these conditions was higher among the patients who were examined roentgenographically, it is believed that some cases among the remainder of the patients may have been missed.

The authors compare the incidence of mediastinal emphysema and pneumothorax among patients in whom the bronchoscope (or other airway) was in place at the time of operation, with that among patients in whom the bronchoscope was not used. The development of mediastinal emphysema and pneumothorax was greater among the patients in whom the bronchoscope had not been used, and indicates the importance of a free airway at the time of tracheotomy, to prevent the suction of air into extrarespiratory tissues.

Treatment consisted of the prevention of further infiltration of air. In the more serious cases, the air was sucked out with a needle and an oiled syringe.

CLINTON H. THIENES, M.D.

MISCELLANEOUS

An Evaluation of Methods of Penicillin Therapy in Thoracic Surgery. JOHN H. DONNELLY, FRANCIS J. PHILLIPS, J. P. BARTLETT, and W. E. ADAMS. *Ann. Surg.*, 1947, 126: 579.

Believing that the penicillin titers in body fluids formed a more accurate appraisal of therapeutic effectiveness than mere clinical estimate of improvement, the authors undertook the present study with particular reference to thoracic surgery. Penicillin levels in blood serum or pleural fluid after administration of the drug, therefore, form the basis of such appraisal. The routes of administration investigated were intramuscular, intratracheal, by inhalation of a combination with aerosol, and intrapleural.

The observations were made in human subjects in 85 instances and by 46 experiments on dogs. The observations in human beings and animals were generally well correlated except when the drug was given intrapleurally, in which instance it seemed to be absorbed much more rapidly in dogs than in man. Also, the inhalation method presented obvious mechanical difficulties in dogs.

The blood serum levels obtained following the administration of penicillin by the various routes is summarized graphically in the accompanying illus-

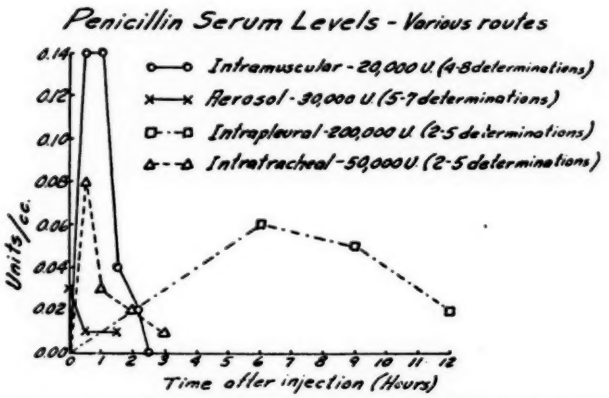

Fig. 1. (Donnelly *et. al.*) Chart showing penicillin serum levels (units per c.c.) at given time intervals following administration by various routes. (Courtesy of J. B. Lippincott Co.)

tration. More detailed data, including maximal, minimal, and average levels for each of the investigations, are presented, however.

Concerning the levels in pleural fluid, it is seen that by the intramuscular injection of 40,000 units every 3 hours, good therapeutic levels can be maintained; 20,000 units, however, are less effective. With intrapleural administration the pleural fluid level is high initially, but it remains at effective levels for 4 or 5 days when 200,000 units are used.

Intratracheal instillation and aerosol administration will produce short periods of effective blood serum levels, but their practical usefulness seems limited to local therapy for bronchopulmonary infections.

The intramuscular route is the best for providing desirable blood serum titers and will, when administered in 40,000 unit doses, produce therapeutically effective levels in pleural fluids.

HIRAM T. LANGSTON, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

The Subcutaneous Inguinal Ring: A Clinical Study. JAMESON L. CHASSIN. *Surgery*, 1947, 22: 540.

Of 5,956 subcutaneous inguinal rings in 2,978 men studied by the author, 78.1 per cent were large enough to admit the index finger without force. This is at variance with the published statements by a number of investigators. Of the 724 men whose subcutaneous rings were not bilaterally equal in size, 57.5 per cent were larger on the left side, whereas it is generally known that hernias occur more often on the right side. The author believes that there is no convincing proof that a large subcutaneous ring either is in itself abnormal or that it predisposes to the future development of hernias. He believes that it should not disqualify men from industrial employment. ROBERT TURELL, M.D.

Internal Supravesical Hernia. ROY MILLER. *Brit. J. Surg.*, 1947, 35: 84.

The author described a rare type of hernia known as internal supravesical hernia. The supravesical fossa is a triangular area bounded laterally by the lateral umbilical fold of peritoneum covering the obliterated umbilical vessels and below by the reflection of the peritoneum on to the dome of the bladder. This fossa is divided in the median plane by the fold of peritoneum over the urachus. Below the peritoneal reflection is the potential space between the symphysis pubis and the bladder which is known as the prevesical space or the space of Retzius.

Men are affected more commonly than women in the proportion of 9 to 1. The small bowel is almost always involved, which causes symptoms of high intestinal obstruction. Most cases have usually been discovered at exploratory laparotomy. The treatment is that accorded to intestinal obstruction with strangulation. The hernia is reduced and the sac is obliterated. No recurrence has ever been reported following simple closure of the neck of the sac with interrupted or continuous sutures. In 37 authentic cases there has been a mortality rate of 40.5 per cent. When resection of the bowel is necessary the mortality is increased. In the author's case recovery followed reduction of the hernia and closure of the neck of the sac. ROBERT TURELL, M.D.

GASTROINTESTINAL TRACT

Hematemesis and Melena. F. AVERY JONES. *Brit. M. J.*, 1947, 2: 477.

The change in the form of therapy in cases of hematemesis from a very restricted fluid intake and small transfusions to early feeding and frequent transfusions has been accompanied by a significant and marked drop in mortality. Liberal drip transfusions and early feeding actually reduce the risk of

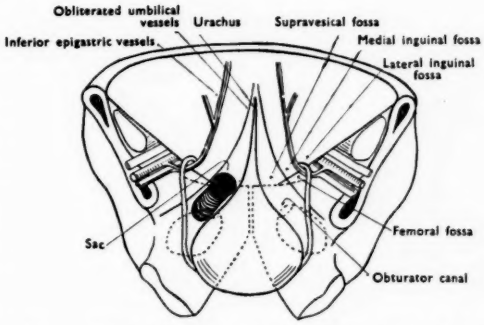

Fig. 1. (Miller) Drawing showing the position of the hernia.

further bleeding and lower the mortality of recurrent hemorrhage. These statements are supported by statistical data. Autopsy reports of fatal cases treated by the older method show that in 18 of 39 cases the hemorrhage had ceased at the time of death and that many of the patients had not bled for some days previously. The authors believe that these deaths were due to uremia which was the result of the extreme dehydration brought on by the form of therapy.

Errors in diagnosis may arise: disorientation from cerebral anoxia may be the presenting symptom and the melena may not be discovered until the patient is in the hospital; dyspnea, edema, and distended jugular veins may lead to an erroneous diagnosis of congestive failure; cardiac pain from recent acute anemia may lead to an erroneous diagnosis; or the history of red blood in the stools may lead to the admission of the patient for hemorrhoids. Dark red fluid stools have often been observed after a brisk recurrent hemorrhage and the absence of the classical "tarry" character may be misleading. Observations following the oral administration of citrated blood in man have shown that from 100 to 150 ml. of blood are necessary to produce a tarry stool, while the administration of 2,000 ml. of blood by means of a Rehfuss tube into the upper gastrointestinal tract in a 4 hour period frequently resulted in stools entirely bloody but never tarry, presumably from intestinal hypermotility. The appearance of the patient soon after the hemorrhage is extraordinarily misleading. The profound circulatory collapse and deathly pallor may disappear within an hour with great clinical improvement. The initial pallor is probably due to the intense vasoconstriction which may occur as a response to hemorrhage. Fever after gastroduodenal hemorrhage is common and may persist for some days. The fever is not due to the presence of blood in the intestine but is possibly

related to the endogenous breakdown of body protein. The persistence of pain after a hemorrhage is well known to be uncommon, but the mechanism of this relief is unknown. Pain persisting after a hemorrhage is a bad prognostic sign and severe persistent pain has been noted only in fatal cases. Coronary thrombosis may be precipitated by the hemorrhage. Amaurosis is a well recognized and tragic complication of gastroduodenal hemorrhage; the vasoconstriction following bleeding may so severely reduce the blood supply to the optic nerve that irreversible damage from anoxia ensues.

It is well recognized that many of the patients with hematemesis and melena fail to show any evidence of peptic ulcer when a barium meal is given during convalescence. To investigate the cause of the bleeding in this group early gastroscopy was performed usually between the third and tenth day. In 60 per cent of these cases superficial acute ulcers were found to be the source of the bleeding, and because of their size and rapid healing they would not be visualized by barium meal later in the convalescence. Atrophic and hypertrophic gastritis is more rarely the cause of the hemorrhage. Patients bleeding from an acute ulcer had a much better prognosis than those bleeding from a chronic ulcer. Because of the much better prognosis of acute ulcers it is necessary to distinguish them, if possible, at the bedside, especially when the question of surgical intervention arises. Bleeding may be very severe from such ulcers and recurrence of the bleeding after admission is not uncommon. The pain of acute ulcers, if present, is never severe and has seldom lasted more than 2 weeks, while the absence of pain in these cases is a common history.

While heavy sedation should be avoided in the treatment, early reassurance and lessening of anxiety is important. A decision should be made early as to whether operation is to be considered if the patient bleeds again. An hourly pulse and blood pressure chart is kept and blood typing performed. The patient is allowed a semisolid puree diet with 2 hourly feedings or 200 ml. of milk if preferred. Antiacids are not essential but may be given. In severely ill patients with a long history a continuous milk drip may be of value, at least during the night. If the vomiting reflex is diminished and the stomach distended with blood, aspiration of the stomach is indicated. Oxygen therapy and the administration of vitamins B and C may be helpful. There was an 8 per cent mortality in the current series.

F. J. LESEMANN, JR., M.D.

The Effect of Vagotomy on Human Gastric Function. ARTHUR M. SCHOEN and R. ARNOLD GRISWOLD. *Ann. Surg.*, 1947, 126: 655.

The authors summarize current opinion as to the etiology of ulcer and suggest that it may be secondary to (1) alterations of psychogenic or neurogenic origin, (2) alterations of the function of cells of internal or external secretion, (3) local alterations of the mucosal anatomy or physiology of the affected mucosa, or (4) a reduction of the constituents of gastric contents produced by other organs such as the liver, pancreas, salivary glands, and the duodenum. It is likewise believed that the mechanism for the production and maintenance of peptic ulcer is the proteolytic activity of the gastric contents versus the mucosal resistance to devitalization and ulceration.

The purpose of this article is to point out a few of the common fallacies known to be present in the method used in determining gastric secretion by continuous gastric suction, and to describe briefly a new and more satisfactory method of measuring the function of the human stomach.

The method employed in this study of 30 patients consists of injecting into the empty stomach an isotonic solution containing a known amount and concentration of indicator (phenol red), and, after a 15 minute rest period, aspirating the entire gastric residual contents. From the values of quantity and concentration of indicator injected and aspirated, can be calculated the average rates of gastric secretion and emptying during the test period.

By means of this test it is shown that the gastric secretory response to histamine, a humoral secretagogue, is not prevented by complete vagotomy. Therefore, a vagotomized stomach is still capable of producing active digestive juice. Complete vagotomy reduces gastric secretion and emptying by abolishing the cephalic phase of gastric function. Peptic activity, however, is least reduced.

In 6 patients, the basal gastric secretory rate was reduced by an average of 36 per cent following vagus resection. The authors conclude that the insulin test (hypoglycemia acts as a potent medullary stimulus to vagus function) for complete vagus nerve section appears to be satisfactory when carefully employed.

EDWARD F. LEWISON, M.D.

Gastric Neurectomy for Gastric and Duodenal Ulceration. WALTMAN WALTERS, HAROLD A. NEIBLING, WILLIAM F. BRADLEY, JOHN T. SMALL, and JAMES W. WILSON. *Ann. Surg.*, 1947, 126: 1.

A study of the anatomy of the gastric nerves has demonstrated that in 92 per cent of the cases the nerves pass through the diaphragm as two distinct trunks and are readily accessible for resection.

The abdominal approach to the gastric nerves allows exploration of the abdominal contents, and especially the ulcer; if it is a gastric ulcer and is suspected of being malignant, it is removed and if the duodenal ulcer is obstructive or likely to become obstructive from gastric atony, a drainage operation of the stomach is performed.

In the authors' series of 33 cases, it is important to remember that the disturbances of gastrointestinal motility were, for the most part, temporary, although spasm of the pylorus with dilatation of the stomach and hypermotility of the intestine has persisted for several weeks in one patient operated upon for gastric ulcer. In one case gastric ulceration definitely recurred.

In the entire series of 66 cases, perforation of a duodenal ulcer and a subdiaphragmatic abscess caused the death of the patient 14 days after gastric neurectomy and gastroenterostomy, and 2 other deaths occurred, 1 from a suspected cerebral embolism on the fourth postoperative day, and the other at home from a heart lesion. This patient had been subjected to closure of a gastrojejunocolic fistula and gastric neurectomy 3 months previously. In other cases the immediate results, as evidenced by reduction in gastric acidity, gastric secretion, relief of gastrospasm and relief of pain, were good but not striking. If the good results persist, the operation offers an easy and a comparatively safe method of treating certain peptic ulcers, especially recurrent ulcers. It will have a limited application in cases of obstructing duodenal ulcer and in certain cases of gastric ulcer. In the former, it can be used in a few cases in association with gastroenterostomy. In cases of gastric ulcer, excision of the ulcer should be done to exclude malignancy. When excision of the ulcer and gastric neurectomy have been done simultaneously, disturbances in gastric motility, with retention and higher secretion, have been troublesome. In any case, however, sufficient time must be allowed to pass to determine whether the good results are temporary, as they seem to be in experimental animals, and whether untoward results may develop.

Subtotal Gastrectomy for Gastric Ulcer. HENRY K. RANSOM. *Ann. Surg.*, 1947, 126: 633.

The author stresses the differences which exist between gastric ulcer and duodenal ulcer and summarizes briefly the characteristics of gastric ulcer. The present study represents the author's attempt to: (1) ascertain the risk involved in operation for gastric ulcer and, to some degree, to determine the incidence of malignant growth; (2) make a critical analysis of clinical end-results as far as the gastric ulcer problem is concerned, and (3) discover the incidence and severity of certain side-effects of gastric resection such as postresection symptoms, nutritional disturbances, and blood disorders.

The clinical material consisted of 1,356 patients treated for gastric ulcer during the 20 year period from 1925 to 1945, at the University Hospital, Ann Arbor, Michigan. Of this number, 246 patients (18.9 per cent) required surgical intervention. End-results of gastric resection for gastric ulcer support the view that this is the best means now at our disposal for the treatment of those ulcers which require surgery. The advent of vagal resection is mentioned primarily as an adjunct to gastric resection in an attempt to prevent jejunal ulcer.

The conventional subtotal gastric resection gave the best results regardless of whether a Polya or Hofmeister reconstruction was subsequently done. Three total gastrectomies were performed, but the results were unsatisfactory.

In general the follow-up end-results were found to be satisfactory in 92 per cent of the cases and this compares favorably with any other major surgical procedure. The operative mortality was 7.9 per cent, pneumonia and peritonitis being the leading causes of death.

The author stresses the fact that the proper therapy in gastric ulcer is still predicated upon one's ability to differentiate a benign from a malignant ulcer. In this series, microscopic study revealed malignancy in 10 per cent of gastric ulcers which, even at the time of operation, were unrecognized as neoplastic. This error has been reported as even much higher at other clinics. Therefore, as suggested by Graham and Lahey, it seems just that patients who are suffering from what may seem to be a benign gastric ulcer be urged to accept partial gastrectomy early in the course of the disease. The operation in capable hands can be carried out without a prohibitive mortality and the number of carcinomas discovered will make the risk worth while.

EDWARD F. LEWISON, M.D.

Carcinoma of the Stomach. DAVID STATE, GEORGE MOORE, and OWEN H. WANGENSTEEN. *J. Am. M. Ass.*, 1947, 135: 262.

Gastric resection remains the only mode of treatment that is capable of curing gastric carcinoma.

Cancer ranks second only to cardiovascular disease as the commonest cause of death in this country. One-fourth to one-third of all deaths from carcinoma are due to gastric cancer. As the age of the population increases, the number of persons who die from gastric carcinoma will also grow larger, and it has been estimated that by 1960 as many as 40,000 patients will succumb to gastric carcinoma annually.

An exhaustive review of the world literature on the end-results of the treatment of gastric carcinoma up to 1937 was compiled by Livingston and Pack. More recently Maimon and Palmer, in addition to summarizing and analyzing their results at the University of Chicago, brought the literature up to date. These authors called attention to wide variations in the published data from various institutions and emphasized the need of analyzing all published statistics with respect to four factors: the total number of patients with gastric cancer, the number of patients subjected to operation, the number of patients in which a gastric resection was done, and the number of survivors in relation to the total.

The total number of patients with gastric carcinoma seen at the University of Minnesota Hospitals over a period of 10 years was 586. Of these, 432 were men and 154 were women. The average age was 63.2 years. Nineteen patients were in terminal stages of the disease when first seen but their cases were included in the statistical data.

The number of patients operated on was 447, an operability rate of 76.3 per cent.

Three hundred and seven patients underwent gastric resection, a resectability rate of 52.2 per cent. In this group there were 31 total gastric resections and 276 partial resections.

The operative mortality among the 307 patients subjected to gastric resection was 16.6 per cent.

Among the 276 partial gastric resections, the operative mortality was 15.2 per cent, and among 31 total gastric resections the operative mortality was 30 per cent.

Eighty-five exploratory laparotomies were performed with a mortality rate of 8.2 per cent, 25 gastrojejunostomies with a mortality rate of 24 per cent, and 30 enterostomies with a mortality rate of 13.4 per cent.

There were 51 deaths following gastric resection, and in 44 of these it was possible to obtain autopsies. The major cause of death was peritonitis which accounted for 28 fatalities; 8 patients succumbed to pulmonary complications, 4 died of cardiac failure, 3 of renal complications, 2 of pulmonary embolism, 1 patient died of cerebrovascular accident, and 1 of shock; in 4 cases the cause of death was undetermined.

Because sufficient time has not elapsed, the percentage of patients surviving for periods of 3 and 5 years can only be determined in relation to those patients who were operated on in the periods from 1936 to 1943 and from 1936 to 1941. The percentage of patients surviving 3 years after gastrectomy was 10.7 per cent, but based on the number of patients subjected to gastric resection, it was 29.4 per cent. The percentage of patients surviving 5 years was 6.6 per cent, but determined on the basis of the number of patients surviving gastric resection it was 21.5 per cent.

Gastric resection was the only palliative procedure of value. The average number of months of palliation following gastric resection was approximately 22. In the main the patients were comfortable up to the last few weeks before their death.

The operability and resectability during the 10 years of study have increased markedly. In 1936 the operability and resectability rates were 57 per cent and 28 per cent whereas in 1945 these rates were, respectively, 88 and 80 per cent. The resectability rate for 1945 based on the number of patients explored was 89.7 per cent. The mortality rate for partial gastric resection in 1936 was 25 per cent, while in 1945 it was 4.9 per cent, which figure includes both total and subtotal gastrectomy.

HARRY W. FINK, M.D.

Report of Prolonged Follow-Up Study of 2 Patients who Underwent Partial Gastrectomy When Young. PAUL MCGUFF and CARL G. MORLOCK. *Gastroenterology*, 1947, 9: 307.

The need for a major surgical procedure of any type on the stomach of a child is infrequent. Rarely, indeed, is it found needful to sacrifice the greater portion of a child's stomach. Because of this and the attention that has been drawn to the nutritional disturbances which sometimes follow partial gastrectomy, the authors deemed it worth while to report the cases of 2 patients who underwent partial gastrectomy when young and were followed up for a total of 21 and 30 years, respectively. Normal physical development and excellent health have been the experience of one patient. Half of this patient's stomach had been removed when she was 10 years old. In the second case, approximately a fourth of the stomach was removed. The patient was 16 years of age. Postoperatively she developed normally and remained well for 30 years, except for some difficulty in maintaining her weight.

Peptic Ulcer: A Diagnostic and Therapeutic Problem. SARA M. JORDAN. *Gastroenterology*, 1947, 9: 237.

Among the large group of diseases influenced by psychic factors, there is probably none in which the psyche plays any greater part than in peptic ulcer. Therapeutic measures are deficient if they fail to include adequate protection of the mental and nervous state of the patient. In any consideration of physical conditions with psychosomatic aspects, however, it must always be remembered that the somatic factor is a real one, and that there may even be a somatopsychic as well as a psychosomatic interplay.

Opinion is now rather general that peptic ulcer is associated in origin with a combination of three factors: increased muscular contraction which is commonly termed spasm, increased secretion of hydrochloric acid, and decreased resistance of the mucosa to these two abnormal factors. The basic etiology behind these factors remains unidentified. There is an etiologic influence from the mind and nervous system upon the genesis of ulcer. It is likewise certain that other influences also play an etiologic role—such as infections elsewhere in the body, e.g., respiratory infections, the toxic effects of alcohol and smoking, habitual irritation from food which is difficult of digestion. And behind all these influences there must, of course, be a predisposing factor which causes certain individuals to be gastrically and intestinally sensitized to these influences, while others are entirely resistant. Whether that basic predisposition is dependent upon localized diminished resistance or upon a hormonal defect, or upon some other as yet unconceived factor remains an unsolved problem.

Once a diagnosis of peptic ulcer is accurately made, it carries with it certain very definite therapeutic involvements, some of which may be permanent throughout the life of the patient. It is of prime importance to the patient that a timely diagnosis be made so that a decision concerning later habit restrictions or lack of restrictions is logically made. Clinical experience tends to show that peptic ulcer is too infrequently diagnosed rather than too frequently diagnosed. The typical ulcer history is well defined, its main points being periodicity and time relationship to meals, coupled with relief by food, even cold food, and by alkalies. A history of ulcer may, however, become completely atypical when other disease, organic or functional, such as a cholecystic lesion or an irritable colon, masks the clinical picture. In this respect one must always analyze carefully the history of a suspected ulcer recurrence, inasmuch as certain of the therapeutic measures for ulcer, especially magnesium and the silicates, may

produce a small intestinal and colonic irritability, the symptoms of which may be confused with those of recurrent ulcer. Extreme care in eliciting and evaluating the history is essential in these cases, since important determinations for or against radical treatment are often made on the basis of relief, or failure of relief, of symptoms, and symptoms cannot be effectively relieved unless adequately diagnosed.

The diagnosis of peptic ulcer is never aided by physical examination of the patient, except when confirmatory evidence is supplied by the finding of localized tenderness. Chemical findings, particularly free hydrochloric acid and occult blood in stools, are significant diagnostic data. An active duodenal or jejunal ulcer is rarely seen without high acid findings, and the course of healing of duodenal ulcer may often be gauged by the change in acid values. It is unnecessary to use fractional analysis in most cases —an Ewald meal and aspiration 45 minutes later gives adequate data. In gastric ulcer only the presence or absence of free acid is important, since an active gastric ulcer is less commonly attended by hyperchlorhydria than is the duodenal lesion. In untreated cases achlorhydria should be regarded as a finding suggestive of malignancy; however, the corollary of this statement, namely, that gastric carcinoma is always attended by achlorhydria, is not dependable since probably 40 per cent of patients with gastric carcinoma have free acid. The finding of occult blood in the stools is important only when conditions of food intake and gum bleeding are very carefully controlled. Under these circumstances, of course, persistent occult blood means unhealed ulceration and if this continues under treatment of a gastric ulcer, malignancy must be suspected.

X-ray and endoscopy, particularly when the latter supplements the former, are our best aids in the diagnosis of esophageal and gastric ulcer, and x-ray alone in the diagnosis of duodenal and jejunal ulcers. In about 30 per cent of cases it is impossible to make an accurate diagnosis of peptic ulcer without the use of fluoroscopic as well as film examination. In all cases fluoroscopy supplements film examination to such an important degree that it should never be omitted. This is especially true when there is a question of supplanting medical with surgical treatment or when a patient with ulcer is under treatment and the course of healing or the question of recurrent activity is being determined. Irritability in the still active or recurrent duodenal or jejunal ulcer is indicated by rapid filling and emptying of the bulb, or by marked spasm in the duodenal bulb or at the stoma. One of the most valuable procedures developed during the last 10 years of radiographic work with peptic ulcer is the visualization of the rugal pattern of stomach, duodenum, and jejunum. The grossly deforming ulcer of the duodenal bulb is obvious both in the fluoroscopic and film examination. However, a differentiation must often be made between the active and quiescent ulcer, and fluoroscopy is then the best diagnostic aid since it reveals rapid filling and emptying and spasm so characteristic of the active phase of ulcer. One of the fundamentals of good gastroenterology is complete familiarity with fluoroscopy and film reading. The knowledge of the physiology and of the pathologic abnormalities and aberrations of the digestive tract obtained by skill in this field is a priceless acquisition for the gastroenterologist.

The therapeutic measures have in large measure been directed toward the neutralization of gastric acidity and the alleviation of spasm. The problem of gastric ulcer is a different matter. Here we are dealing with a lesion of which we know that it is sometimes a wolf in sheep's clothing—that it may look like a benign ulcer and yet harbor malignant changes within itself which sooner or later will convert it into an invading carcinoma. The question arises: can gastroenterologists take the responsibility of differentiating between the lesion which is potentially innocent and that which is or will be malignant? If they use adequate caution, they can. The unhealed ulcer and the recurrent ulcer, when located on the gastric side of the pylorus, are the threat to safety; in other words, it is the question of chronic irritation in a terrain highly susceptible to malignant changes. Two principles should be observed meticulously: the first that the gastric ulcer, however benign it may appear, should be closely watched to the point of absolutely complete healing, a process which should occur within 3 to 5 weeks at the most. The criteria for healing are the same as have been used in the past—that symptoms, occult blood, and x-ray defect shall completely disappear with trial management, but many cases are checked gastroscopically as well as by x-ray for complete healing. All recurrent gastric ulcers, however benign they may appear to be, must have gastric resection. If these two principles are carefully observed, gastric carcinoma in an ulcer will not be missed.

A survey of gastric ulcers is being carried out; it is still incomplete, but figures thus far indicate an incidence of about 10 per cent malignancy in lesions which looked like ulcer and of about 2 per cent in cases in which continued medical treatment was too long. The differentiation of duodenal ulcers as to whether they should be treated medically or surgically is chiefly a matter of tractability. The duodenal ulcer with complications is also often a surgical problem. Here, however, two observations based on experience should be made: (1) the obstructed ulcer is often not truly obstructed; (2) the ulcer with a history of multiple hemorrhages may prove to be as unsatisfactory after surgical as after medical treatment. With regard to obstruction, in many instances apparent obstruction is due not to cicatricial narrowing which requires surgical intervention, but to edema and inflammation from an acute ulcer which is relieved by a few days' medical management and will not recur if the ulcer heals and remains healed. The adequacy of previous medical treatment should be given careful consideration before surgical intervention is advised. A few days of hospital rest under an ulcer management based on the Sippy regime, though

often modified to the individual requirements, results in clinical relief of all symptoms and in x-ray evidence of healing, unless the ulcer is intractable. In cases in which night pain has been a feature, this is relieved in a few days by nocturnal hourly administration of a neutralizing medication, if it is to be controlled at all by medical management. Tractability is, therefore, easily determined clinically as well as by x-ray within a very reasonable time, a week at the longest. This fact, in addition to the very compelling reason that rest, neutralization, and education can best be accomplished with the patient in the hospital under constant observation, makes hospitalization most advantageous.

Enterogastrone and vagus resection are fledglings whose development merits careful observation with the hope that either one may provide a short cut in ulcer therapy; if an ulcer is detected early enough, and often even when it is diagnosed late, if it is treated intensively by the routine method of rest and neutralization, good results can be expected, and with thorough education of the patient as to the nature of the disease and with his co-operation or control, permanent freedom from recurrence may be expected. CHARLES BARON, M.D.

Gastric Neurectomy: Anatomic and Physiologic Studies with Favorable and Unfavorable Results in the Treatment of Peptic Ulcer. WALTMAN WALTERS, HAROLD A. NEIBLING, WILLIAM F. BRADLEY, JOHN T. SMALL, and JAMES W. WILSON. *Arch. Surg.*, 1947, 55: 151.

Reports of other surgeons led the authors to study the problem of resection of the vagus nerves, or, as they prefer to call the operation, "gastric neurectomy," from the anatomic, physiologic, and chemical standpoint in 40 patients operated on at the Mayo Clinic up to January 15, 1947.

Only brief reference will be made to additional cases in which operation was performed by other surgeons at the clinic, for they will individually report on their results in detail later.

Anatomic dissections of the gastric nerves made on 56 men, 44 women, and 11 children during the course of postmortem examinations indicated that the gastric nerves could be located and successfully resected near the diaphragm by either a transabdominal or a transthoracic approach in approximately 92 per cent of the cases, and that possibly most, if not all, of the branches in the remaining 8 per cent also could be located in the same way.

Results of gastric neurectomy are inconstant, variable and, in most cases, unpredictable. The relief of pain obtained may be the result of the release of gastrospasm and a reduction in gastric acidity as a result of the interruption of cephalic stimulation. The expense of this relief of pain is dilatation of the stomach with frequent troublesome retention of gastric secretion and, in some cases, food remnants. Moreover, that relief of pain is not the result of healing of the ulcer must be considered since in one case acute perforation of duodenal ulcer developed.

In one case a gastric ulcer recurred; in other cases failure of the ulcers to heal has been demonstrated pathologically at subsequent operations necessitated by a continuation of bleeding or a marked degree of gastric retention which interfered with the patient's nutritional state.

Reduction in gastric acidity, although it has occurred in most cases, is inconstant in others and the disturbances of motility of the stomach and small intestine are frequent after operation. In some cases these disturbances are temporary and in others prolonged, persistent, and troublesome to the patient. In such cases patients have complained of frequent belching of foul smelling gas, fullness and bloating after meals, and a few patients have complained of nausea and diarrhea. Subsequent operations have been necessary in some cases to remove the persistent ulcer or to provide drainage.

There have been three hospital deaths in these 83 cases. Although 2 of these could be directly attributed to cardiovascular accidents, 1 patient died of unsuspected perforated duodenal ulcer with a subdiaphragmatic abscess. Gastroenterostomy had been done at the time of the gastric neurectomy. Another patient died from a coronary occlusion at home, 3 months after the closure of a gastrojejunal colic fistula.

In evaluation of the results of the operation, it must be proved that an ulcer is present and that the gastric nerves have been completely sectioned. It is the opinion of the authors that the best approach in most cases in which gastric neurectomy is contemplated is by means of a transabdominal incision, for this approach permits exploration of the gastrointestinal tract and such procedures as are necessary to supplement the gastric neurectomy. The greatest field of usefulness for the operation seems to be in the treatment of ulcers after partial gastrectomy and in certain cases of nonobstructive duodenal ulcers in which the cephalic phase of gastric secretion is marked and pain is intractable.

In view of the inherent ability of the gastrointestinal tracts of human beings, like that of animals, to regain through compensatory mechanisms their function after operative procedures which disturb the neuromuscular continuity, and in view of the fact that restoration of gastric acidity and gastric motility has occurred within 2 years in dogs in which gastric neurectomy has been performed, the possibility of such a return in human beings must be kept in mind.

For the time being the operation of gastric neurectomy will have to be considered as in the investigative stage.

The Management of Patients with Massive Hemorrhage from Peptic Ulcer. SEYMOUR J. GRAY. *Med. Clin. N. America*, 1947, 31: 1121

Every patient admitted to the hospital with a massive hemorrhage from the upper gastrointestinal tract must be considered a potential fatality. The management of this condition is a challenge, and

sound clinical judgment and the constant observation and re-evaluation of the status of the patient are essential.

Definite establishment of a diagnosis is imperative when a patient is admitted with hematemesis or tarry stools associated with dizziness, weakness, tachycardia, and perspiration.

Peptic ulcer causes 75 per cent of all massive hemorrhages. A history of previous ulcer or ulcer distress, previous attacks of hematemesis or melena, or positive x-ray evidence of a crater or deformity indicates ulcer as the possible source.

Hypertrophic or erosive hemorrhagic gastritis, esophageal varices, cancer of the stomach, gastric polyps, diaphragmatic hernia, or blood dyscrasias are other sources of hemorrhage.

When the diagnosis is still uncertain after the workup is complete, roentgen examination may be undertaken from 24 to 48 hours after severe hemorrhage, or earlier, provided the patient is not in shock.

The state of shock, hemorrhage, and dehydration must be evaluated and treated. The blood type, including the Rh factor and cross matching, should be determined first. Repeated hemoglobin, red blood count, and hematocrit determinations are necessary. A low blood prothrombin time is not infrequently seen in patients with massive hemorrhage from an ulcer. Vitamin K is helpful in these cases. All stools and vomitus should be examined for gross and occult blood as an aid in evaluating the extent and course of the hemorrhage. Plasma proteins, blood urea nitrogen, blood chloride, and carbon dioxide content of the blood must be followed up carefully.

Massive transfusions if given slowly do not cause an appreciable rise in blood pressure and do not produce further hemorrhage. Blood transfusions combat shock, exsanguination, and hypoproteinemia and tend to exert a beneficial effect upon the patient's welfare. The contraindication of post-transfusion reaction has been eliminated almost entirely by typing, cross matching, and determining the Rh factor in each case.

During the first 48 to 72 hours, parenteral fluids are necessary to maintain the circulating blood volume, re-establish the normal electrolyte balance, and combat dehydration and azotemia. Enough fluids should be given (electrolyte requirements as indicated by the blood chemistry) to maintain an adequate daily renal output. Excessive amounts of fluids and too rapid administration should be avoided. The total daily intake should approximate from 2,000 to 2,500 c.c.

The starvation treatment of bleeding ulcers is outdated as the empty stomach neither prevents the secretion of acid nor decreases gastric motility. Small hourly feedings should be given if they are tolerated by the patient. This maintains the nutritional state, arrests hemorrhage by reducing the gastric acidity and decreasing the gastric motility, and speeds blood regeneration. Patients treated this way have a lower mortality than those treated with the starvation regimen. Hourly feedings of 100 c.c. of milk and cream should be given from 7 in the morning to 10 at night and feedings continued at 2 hour intervals through the night. This routine is continued till the stools are negative for occult blood for 3 days. The usual ulcer regimen with supplementary small feedings is gradually changed to a 3 meal management within 2 weeks. Intubation should be avoided in patients with massive hemorrhage.

High acid gastric juice may favor the extension of the ulcer and may digest the fibrin clot which forms at the bleeding point. As complete and constant neutralization of acid secretion throughout the day and night is desired, further neutralization than can be achieved with milk and cream may be necessary. Calcium carbonate, tribasic calcium phosphate, tribasic magnesium phosphate, and aluminum hydroxide are recommended. The addition of from 5 to 10 c.c. of colloid aluminum hydroxide to the hourly milk and cream is adequate antacid therapy.

Reassurance, good nursing care, and sedatives contribute appreciably to the success of the treatment. The patients should be kept in bed until all evidence of bleeding has disappeared and the hematocrit and hemoglobin are within normal ranges.

Antispasmodics such as atropine, in a dose of 0.6 mgm. 4 times a day, reduce motor and secretory activity of the stomach.

Secondary deficiencies of vitamins C and K may be avoided by the use of parenteral or oral supplements.

The treatment of choice in acute massive hemorrhage from peptic ulcer is medical but the possibility of a fatal hemorrhage, particularly in patients over 50, should always be considered. Surgical intervention should be carried out when necessary within from 24 to 48 hours as the mortality increases rapidly after this period. The surgical service should see all these patients in order that delays may be avoided if surgical intervention becomes necessary. Subtotal gastrectomy is the treatment of choice as simple ligation of the bleeding points is unsatisfactory and leads to secondary hemorrhage. Each case must be judged individually. A hemorrhage is more likely to be fatal in a patient over 50. Fatal hemorrhages are less likely in women than in men. Chances of recovery are better after multiple hemorrhages than after the initial hemorrhage. Certain medical contraindications to emergency surgery may be present. Approximately 70 per cent of the patients with 2 or more hemorrhages are likely to suffer from further hemorrhage. If there are no contraindications, elective surgery should be contemplated for this group. Careful gastroscopic examination to determine the presence or absence of gastritis should be carried out prior to any surgery.

The management of older patients with massive hemorrhage from peptic ulcer presents a difficult problem. Short summaries of the cases of 6 patients between 65 and 79 years of age are given.

All patients who have experienced a massive hemorrhage from peptic ulcer should be observed and studied periodically after their recovery.

ROBERT R. BIGELOW, M.D.

Vagus Resection for Ulcer: An Interim Evaluation. FRANCIS D. MOORE. *Ann. Surg.*, 1947, 126: 664.

In a previous article the author describes the operative technique, postoperative management, and hospital morbidity and mortality of vagus resection for ulcer at the Massachusetts General Hospital, in Boston. In his present contribution he reports the clinical results obtained in these patients 2 to 30 months after operation.

It is pointed out by the author that vagus resection for ulcer is at the crossroads, that it is well known as an effective weapon in dealing with ulcer, and that the approximate magnitude of the operative side-effects is also known, as well as the degree of its failures. The accumulation of factual information must now be utilized to balance the significant advantages against the shortcomings so as to arrive at an evaluation of lasting significance.

The results following vagus resection for ulcer in 74 patients (both private and charity) at the Massachusetts General Hospital are analyzed and a satisfactory end-result was reported in 90 per cent of the cases.

Among the side-effects following vagus resection, diarrhea was present in 62 per cent of the cases, but it was minor or transient in all but a few cases. Emptying disorders were less common and less important than diarrhea and were taken as a matter of course in most cases. Severe wound pain was uncommon despite the fact that the patients in this series of cases were operated upon by the thoracic route.

Good results were obtained in patients who were intractable to all other forms of therapy, including subtotal gastrectomy. The author believes that vagus resection is an addition to the surgical armamentarium and that it may come to occupy a permanent and important place, although a reserved attitude must be maintained until the present groups of patients have been followed longer.

EDWARD F. LEWISON, M.D.

Resection and Primary Anastomosis in the Treatment of Gangrenous or Nonreducible Intussusceptions in Children. CLARENCE DENNIS. *Ann. Surg.*, 1947, 126: 788.

During the period between November 1, 1940 and March 1, 1947, the authors performed 8 resections for intussusception at the University of Minnesota Hospital, Minneapolis. Exteriorization and delayed closure was done in 1 case and primary, aseptic anastomosis in 7 cases. All patients recovered. The indications for resection were: infarction of intussusceptum in 5 cases; recurrent intussusception with polypoid Peyer's patch in 1 case; developing recurrence while being observed for viability, and Meckel's diverticulum in 1 case; irreducible intussusception due to a large polyp in 1 case.

The choice of procedure lies between exteriorization and early closure on the one hand, and resection and primary closure of anastomosis on the other. With a background of closed anastomoses, the latter course is preferred here. A simple and safe type of one layer, closed anastomosis with silk sutures was presented.

CHARLES BARON, M.D.

Duodenal Regurgitation. ARTHUR R. METZ. *Arch. Surg.*, 1947, 55: 239.

The author considers duodenal regurgitation as a clinical entity that has not received proper emphasis by clinicians in previous years.

Its most common cause is pressure on the duodenum by the mesenteric attachment where this part of the intestine passes over the spine. Obstruction may also result from lack of proper rotation of the intestinal tract, tumor, or adhesions. It is usually associated with ptosis of the abdominal viscera.

Symptoms vary with the degree of obstruction. When slight there are recurring attacks of nausea, with disturbed appetite and weight loss. As the obstruction becomes more marked the attacks of nausea increase and are followed by a sense of fulness in the right upper area of the abdomen and by vomiting; these commence after the patient begins eating. In the progressive case the anorexia and pernicious vomiting result in extreme dehydration, emaciation, gradual exhaustion, and death.

This condition should be suspected from a history of repeated nausea and vomiting not explained by ordinary causes. A positive diagnosis is made by fluoroscopic examination of the stomach and duodenum. The stomach is large and J-shaped with a highly placed outlet. The duodenum is dilated to several times its normal size. A barium meal will be observed to stop at the right of the spine, churn back and forth because of hyperperistalsis, and then regurgitate back into the stomach. After a delay of several minutes the barium may be forced over the spine to move along its usual course.

Treatment depends on the severity of obstruction. When slight, medical management should be instituted: regulation of food intake, rest at mealtimes, and various positions of the body postprandially. Further treatment consists of bed rest and frequent small feedings. If the patient does not make satisfactory progress with this type of therapy, surgical intervention is indicated.

The accepted surgical procedure is duodenojejunostomy, which gives complete relief. Care must be taken to make a large stoma to permit prompt emptying of the distended duodenum. Another operation used is a posterior gastroenterostomy with pyloric occlusion.

The author mentions the cases of 15 patients, 10 relieved by gastroenterostomy and 5 by duodenojejunostomy.

C. FREDERICK KITTLE, M.D.

Some Physiologic Aspects of the Surgical Treatment of Duodenal Ulcer. JAMES T. PRIESTLEY. *Surg. Clin. N. America*, 1947, 27: 905.

It is generally agreed that medical treatment should be instituted in all cases of duodenal ulcer except those in which certain complications are present. Experience at the Mayo Clinic indicates

that approximately 85 per cent of all patients with this condition can be treated medically. Complications which are considered to indicate the desirability of surgical treatment, and which will be discussed only briefly, may be listed as primary or secondary. In the former group are included hemorrhage, obstruction, perforation, failure of medical management, and any doubt as to the benignity of the lesion.

At present it is the practice at the clinic to institute medical treatment in all cases in which massive bleeding from duodenal ulcer occurs. If, after medical treatment has been continued for 48 hours, there is still evidence of continued or recurrent bleeding, immediate surgical intervention is desirable.

For the patient who has had several episodes of bleeding one is always a little more inclined to suggest surgical treatment. This is especially true if bleeding occurs under ordinary circumstances, when the patient has been taking at least fairly good care of himself. Medical treatment which failed to prevent hemorrhages in the past hardly can be considered adequate to prevent hemorrhage in the future.

Obstructive lesions caused by duodenal ulcer may be either inflammatory or sclerotic in nature. The inflammatory type of obstructive lesion usually is seen during a subacute exacerbation of symptoms. Under proper medical treatment, symptoms of obstruction generally disappear in a week or 10 days. It is doubtful, however, whether more than one or two such episodes should be treated medically because they are likely to recur and cause sclerotic narrowing of the duodenum. When a definite cicatricial type of obstructive lesion results, there is little to offer but surgical treatment.

Perforation by a duodenal ulcer may be either a subacute or an acute process. All agree that acute perforation of a duodenal ulcer constitutes a surgical emergency. The subacute perforating duodenal ulcer generally is one of pronounced activity, causing varying degrees of penetration through the wall of the duodenum. In the advanced case the entire thickness of the duodenal wall has been eroded and the base of the crater consists of adjacent tissue, usually pancreas. When an ulcer of such pronounced activity is present it is unlikely that medical management will result in satisfactory cure.

Failure of medical management to relieve symptoms of ulcer long has constituted an indication for surgical treatment. Care must be exercised, however, in determining just when failure of medical management has occurred. One should be confident that an adequate regimen has been followed.

Occasionally uncertainty will exist regarding the exact diagnosis in a case of duodenal ulcer. This occurs most often when the lesion is situated at the pylorus and the roentgenologist is unable to say whether it is actually in the duodenum or on the gastric side of the pylorus. A small carcinoma in this vicinity may closely simulate a duodenal ulcer. If any doubt exists as to the benignity of the lesion, surgical exploration should be advised. Thus, if an obstructing lesion at the outlet of the stomach is thought to be a duodenal ulcer, but the gastric acidity is low and perhaps free hydrochloric acid is absent, exploration should be performed.

Besides these primary indications for surgical treatment of duodenal ulcer, there are certain factors of secondary importance, the presence of which tends to favor surgical intervention. These include: a very unfavorable economic status, which virtually prevents the patient from making adequate trial of medical management; the unco-operative nature of a given patient whereby the dietary regimen is not followed; excessive gastric acidity with a value of free hydrochloric acid, possibly of 80 or more (Töpfer's method); a history of duration for many years and symptoms of marked severity. While no one of these secondary factors alone should be considered to constitute a definite indication for operation, when two or more of them exist in the same case, thought should be given to the advisability of operation.

Although one hears many words of condemnation for gastroenterostomy, many patients have experienced an eminently satisfactory result after this operation. It seems that this fact should be kept in mind because, if this operation is performed with proper indication and its technical execution is correct, good results may still be expected in a large majority of cases. True, the possibility of occurrence of jejunal ulcer always remains, but that possibility also exists, to a less extent, after gastric resection. It should be remembered that, in the hands of the average surgeon, gastroenterostomy entails a definitely lower operative risk than does gastric resection.

Gastroenterostomy may be performed as an operation of choice or at times as one of expediency. The patient who qualifies in the former category would be, as a rule, of advanced years; would constitute a poor surgical risk; would have a chronic lesion of long standing, perhaps causing obstruction because of sclerotic changes; would have relatively low gastric acidity; would present a single lesion and no appreciable associated gastritis, and would exhibit a minimal neurogenic factor. At times gastrojejunostomy may be employed in the absence of many of the conditions just mentioned if the technical aspects of gastric resection involve too great difficulty or hazard. Such may be the case in dealing with an ulcer deeply placed in a shortened duodenum, which permits neither removal of the ulcer and satisfactory closure of the duodenal stump without jeopardizing the common bile duct, nor section of the duodenum immediately distal to the pylorus and satisfactory closure of the duodenal stump. This type of lesion in an obese individual with a small, high-lying stomach and deeply placed duodenum makes resection more difficult and hazardous and, therefore, may make advisable something less desirable than the surgical procedure of theoretic choice. As the surgeon's experience increases, technical considerations of this type become less of a factor in his choice of operative procedure.

While there is more than one way of making a gastrojejunal stoma that will permit satisfactory

gastric motor function, the preferred type is as follows: The stoma is placed on the posterior wall of the stomach and is extended almost from the lesser curvature down to the greater curvature in a line running approximately from the patient's right shoulder to his left foot, with the proximal jejunal loop fixed to the lesser curvature of the stomach and the distal loop joined to the greater curvature. The point at which the distal jejunal loop is attached to the greater curvature of the stomach should be directly below the angle of the lesser curvature. One should remember that an enlarged, obstructed stomach will decrease in size after relief of the obstruction with a corresponding decrease in size of the gastroenteric stoma. Two or three rows of sutures may be used. Fine suture material is preferred. The stoma in the jejunum should be placed directly opposite the mesenteric border. Less than 0.5 cm. of stomach or jejunum should be inverted into the gastroenteric lumen, particularly at the point at which the distal loop of jejunum leaves the stomach.

The retrocolic type of anastomosis is preferred. The transverse mesocolon should be sutured to the gastric wall at least 2 cm. removed from the site of anastomosis around the entire stoma. The surgeon must be certain that these sutures actually are placed in the gastric wall in the region of the greater curvature and not in the gastrocolic omentum. This requires that several sutures be passed through the gastrocolic omentum and into the anterior gastric wall at the lower angle of the anastomosis. A short proximal jejunal loop should be used, one just short enough, perhaps 8 to 10 cm. in length, to permit approximation of the jejunum to the lesser curvature of the stomach without tension, yet without appreciable redundancy. At the conclusion of the operation the distal loop of jejunum should be placed so that it lies to the patient's left in the region of the root of its mesentery.

Until vagotomy has had time to prove itself, gastric resection probably should be used in approximately 5 out of 6 cases of duodenal ulcer. Resection is not an ideal procedure for treatment of duodenal ulcer and it is possible that as time passes this procedure may be supplanted gradually by one or more forms of medical or surgical treatment. At present the ideal patient for gastric resection would be a man of middle age, in good general condition, who has failed to obtain relief despite careful and prolonged adherence to a medical regimen, whose gastric acidity is high, who perhaps has experienced recurrent hemorrhages and who has an active lesion for which resection would not be unduly difficult or hazardous. The presence of multiple ulcers and associated gastritis, as well as of a large neurogenic element, would favor resection rather than conservative operation; however, none of these factors makes for a favorable postoperative result.

The Billroth I type of anastomosis is preferred to the Billroth II. More specifically, preference is for the Schoemaker modification of the Billroth I type, in which resection of the stomach is carried higher along the lesser curvature than the greater curvature and the end of the stomach, after closure of the lesser curvature to the desired point, is anastomosed directly with the end of the duodenum. To accomplish this operation one must have an adequate amount of duodenum distal to the ulcer that can be mobilized with a good blood supply. Anastomosis must be accomplished without tension and without limitation of resection of the desired amount of stomach. The end of the gastric stump is so formed, by appropriate closure of the lesser curvature, that its size corresponds with that of the duodenum. The amount of stomach and duodenum inserted into the gastroduodenal stoma should be small in order that an adequate gastric outlet may be maintained. Although crushing clamps may be used, the author's preference is for the so-called open anastomosis performed by the use of rubber-covered Doyen forceps.

In a Billroth II type of resection it has been well demonstrated that short-loop, retrocolic anastomosis is followed by results superior to those obtained when long-loop, antecolic anastomosis is employed. This latter type, which is technically easier to perform, at times may be used for expediency if the patient is fat, the transverse colon short and thick, and the stomach is small and in a high position. Enteroanastomosis between the jejunal loops is unnecessary and undesirable. One may anastomose the entire end of the stomach with the jejunum, or only a part of it after closure of the portion bordering the lesser curvature, according to the method of Hofmeister; the latter procedure is the favored one. None of the prepyloric portion of the stomach should be permitted to remain. Removal of the duodenal ulcer itself is unnecessary so long as satisfactory closure of the duodenal stump is obtained. In practice the ulcer is removed almost invariably. Satisfactory closure of the duodenal stump is most important; likewise it is essential that there be no angulation or other factor which might interfere with free emptying of the proximal jejunal loop, as increased intraluminal duodenal pressure predisposes to leakage from the duodenal stump. The same technical points discussed in connection with gastroenterostomy apply in establishing gastrojejunal anastomosis after gastric resection; namely, approximation of the jejunum and the stomach, direction of jejunal loops, length of the proximal jejunal loop, and suturing the transverse mesocolon well back from the anastomosis.

At present, probably no two gastric surgeons would offer an identical group of indications for vagotomy in the treatment of duodenal ulcer. In general, the author believes that at this time the operation should be reserved for the exceptional type of patient who has duodenal ulcer.

Gastric retention may occur after transthoracic vagotomy performed for duodenal ulcer, even though preoperatively there was no indication of gastric obstruction as shown by clinical or laboratory investigation. Such retention may be severe enough to

require gastroenterostomy. Because of this fact transthoracic vagotomy seldom seems indicated in the treatment of duodenal ulcer. If this viewpoint is accepted, transabdominal vagotomy performed in association with gastroenterostomy would constitute the alternative and more desirable procedure. Evaluation of late results of this method of treatment will require the lapse of a number of years. The abdominal approach presents the advantage of permitting direct examination of the lesion and exploration of the entire abdomen. It has the disadvantage, until the surgeon has gained considerable experience, of making complete resection of all branches of the vagus nerves somewhat less certain.

A prerequisite to the performance of vagotomy is accurate knowledge of the anatomic location and distribution of the fibers of the vagus nerves, both above and below the diaphragm. Failure to section all fibers of these nerves can lead only to confusion and unsatisfactory results.

If a transthoracic approach is employed, resection of a generous portion of the left eighth rib affords fine exposure. Occurrence of a pathologic process previously in the left side of the thorax adds to the difficulties and, in certain cases, may make a right-sided approach more desirable. A generous portion (preferably 3 cm. at least) of each vagus nerve should be resected and an effort made to prevent realignment of the nerve ends, should regeneration occur.

In the abdominal approach a left-sided incision, although it is not essential, aids in obtaining good exposure of the esophagus. Several inches of esophagus should be cleared and extreme care exercised to perform wide resection of all branches of the vagus nerves. A soft rubber catheter, or a strip of gauze on which caudal traction is made after it is looped around the esophagogastric junction, is helpful in obtaining adequate mobilization and exposure of the esophagus. Mobilization adequate to permit rotation of the esophagus in an arc of at least 180 degrees is essential. All tissue removed should be examined microscopically to aid in the thoroughness of the operation and in the ready recognition of the fibers of the vagus nerves.

Volvulus of the Sigmoid Colon and Its Treatment. CHRISTIAN BRUUSGAARD. *Surgery*, 1947, 22: 466.

The author studied 91 patients with volvulus of the sigmoid colon who had been admitted to the Ullevaal Hospital, Oslo, Norway. Believing that in most cases of sigmoidal volvulus there is torsion of the sigmoid with obstruction of the lumen without strangulation and/or serious circulatory disturbances, the author advocated and described a successful nonsurgical method of treatment.

The conditions predisposing to volvulus formation are: (1) a long and freely movable sigmoid colon; (2) a long and freely movable mesosigmoid, and (3) a sigmoid loop whose limbs lie close together. The last condition is encountered in a mesosigmoid with a small fixation angle to the posterior abdominal wall, or may be caused by a shrinking mesosigmoiditis. Sixteen of 18 patients who were either operated upon or examined postmortem had shrinking mesosigmoiditis.

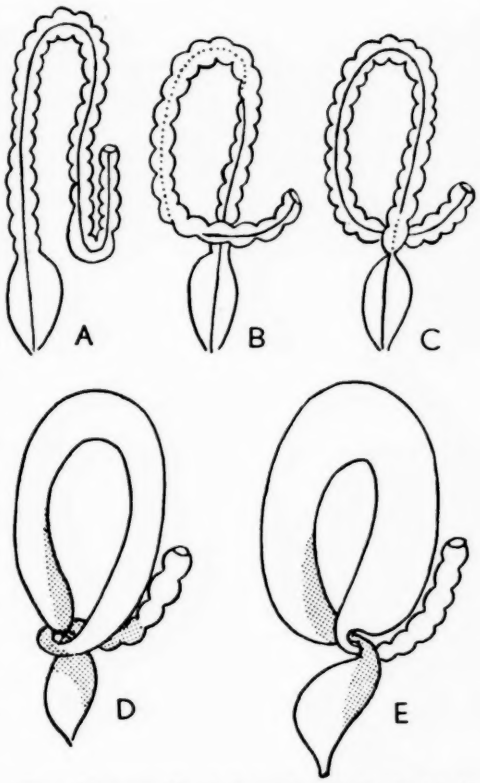

Fig. 1 (Bruusgaard). A, Long sigmoid; B, physiologic volvulus; C, axial torsion of rectal loop of sigmoid in 180 degree volvulus without strangulation of vessels; D, 360 degree volvulus of sigmoid with beginning strangulation; E, 360 degree volvulus with torsion and strangulation.

The most moderate form of sigmoidal volvulus is the so-called physiologic volvulus—one with a clockwise asymptomatic torsion of 180 degrees. This usually corrects itself spontaneously and does not exhibit signs of intestinal obstruction. In 180 degree counterclockwise torsion of the sigmoid there occurs intestinal obstruction with circulatory changes. It is believed that volvulus which causes symptoms develops from the asymptomatic 180 degree physiologic volvulus in most cases. The rectal loop which lies behind the colonic loop may be gradually filled with gas and stool because of retention. The heavy rectal loop then changes its position and falls in front of the emptier colonic loop. Thus torsion of 360 degrees is accomplished. Volvulus of more than 360 degrees occurs rarely.

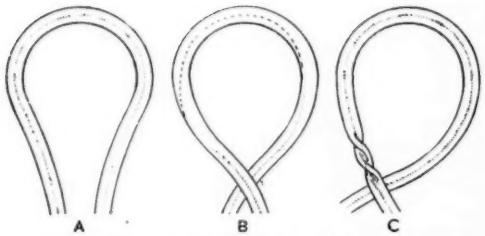

Fig. 2. Development of torsion stenosis. (From Laurell.)

Groth demonstrated that every torsion of the sigmoid and its mesenteric axis is combined with an axial torsion of the bowel itself. This axial torsion is twice as great as the torsion of the mesentery. Thus the axial torsion is 360 degrees in a 180 degree volvulus. The twisting at the axis of the mesentery and the axial torsion about the axis of the bowel which are characteristic of volvulus cause a mechanical ileus in most cases. When the torsion is moderate, a simple type of obstruction occurs. In simple obstruction the intestinal wall is adequately well nourished for the first few days because the sigmoid is most resistant to increasing intestinal pressure.

When the volvulus produces a strangulation ileus, venous stasis occurs. Later, depending on the degree of torsion, thrombosis of the mesentery develops and extends. The strangulated intestinal loop may become gangrenous and perforation with resultant peritonitis may occur.

Distention is most marked in instances of a competent ileocecal valve forming a so-called "closed loop." In these cases the small intestine functions normally for some time with resultant moderate loss of fluid and electrolytes. In the more severe cases there is considerable loss of fluid and electrolytes because of the formation of ascites, hemorrhage, and vomiting. Exudation in the peritoneal cavity is common; a fecal odor signifies grave changes in the sigmoid colon.

The treatment is either nonoperative or surgical. Spontaneous untwisting of the sigmoid colon may occur when torsion is less than 360 degrees; in torsion of 360 degrees the twisted loop is usually held fast between the anterior and the posterior abdominal wall. Detorsion may occasionally follow a simple or a diagnostic barium enema.

The author has successfully employed proctoscopy and intubation with a rectal tube, 60 cm. long and 6 to 10 mm. in diameter, 123 times in patients suffering from acute volvulus but without evidence of serious circulatory disturbances in the sigmoid. A sigmoidoscope is introduced to the site of the torsion with the aid of careful inflation. The site of torsion is easily recognized by the characteristic spiral folds. Then a lubricated soft rubber rectal tube is introduced past the site of obstruction without force. Following the passage of the tube there occurs prompt evacuation of flatus and soft feces, and the patient experiences instant relief. The tube is left indwelling for 2 to 3 days and is held in place by a suture to the perianal skin. In 9 instances attempts at intubation by proctoscopy were unsuccessful, but without ill effects to the patient. These patients, however, were operated upon immediately after proctoscopy.

Proctoscopy and intubation, while effective in the treatment of the acute attack of volvulus, have no effect on the tendency toward recurrence of this lesion. This therapeutic method is therefore not a definitive treatment. Thirty-one of the author's patients had to be readmitted to the hospital and treated two or more times for recurrent volvulus. Only 7 patients with recurrent volvulus were treated by a four stage operation (cecostomy, a Mikulicz procedure, closure of sigmoidostomy, and closure of cecostomy).

Recently, at the Minnesota University Hospitals, Minneapolis, the author observed 2 patients with volvulus of the sigmoid reduced by proctoscopy and intubation. About 2 weeks after the acute volvulus had been reduced these patients underwent a successful primary resection of the sigmoid. As a result of this observation, Bruusgaard now believes that primary resection of the sigmoid colon is superior to the four stage operation employed at the Ullevaal Hospital and should be employed when surgery becomes necessary. ROBERT TURELL, M.D.

Multiple Polyposis of the Colon with Malignant Change Involving Colon and Appendix. BERNARD MAISEL and N. CHANDLER FOOT. *Ann. Surg.*, 1947, 126: 262.

This article consists of a very well documented case history of multiple polyposis of the colon, cecum, and vermiform appendix with malignant change involving the colon and the appendix. It is followed by a brief discussion of this unusual condition.

The patient, a 35 year old female, entered the hospital as a very poor surgical risk due to prolonged blood loss. Following intensive preoperative therapy the authors were able to perform a transverse colostomy. This placed the rectum at rest and permitted the removal of polyps from the splenic and hepatic flexures for microscopic study. The result of this operation led to marked improvement in the patient's general condition.

Next, a right hemicolectomy and ileotransverse colonic anastomosis were performed. The resected specimen revealed multiple polyps, both malignant and nonmalignant, as well as a well developed carcinoma of the cecum; in addition, a malignant adenoma of the vermiform appendix was found.

Finally the authors performed a perineal resection of the rectum and lower sigmoid, and then the stoma of the transverse colostomy was closed. This entire formidable procedure totaled 118 hospital days.

The authors discuss carcinoma of the appendix and point out the great rarity of this condition and its frequent confusion with carcinoids of the appendix, a neoplasm which histologically resembles carcinoma but acts clinically as a benign tumor.

EDWARD F. LEWISON, M.D.

Carcinoma of the Colon. ARTHUR W. ALLEN, CLAUDE E. WELCH, and GORDON A. DONALDSON. *Ann. Surg.*, 1947, 126: 19.

The authors present the data on 105 patients with carcinoma of the colon who were treated since January 1, 1943. This series does not include those with carcinoma of the rectum. Resectability was possible in 95 per cent of the cases.

The period of invalidism following colon resections is dependent on many factors. In spite of the fact that a 2 stage attack is often necessary in the presence of acute obstruction, final resection followed by primary anastomosis has been more satisfactory in the authors' hands than exteriorization procedures. Since the introduction of the Miller-Abbott tube and the use of sulfasuxidine and sulfathaladine in the preparation of patients for colon resections, fewer patients have needed cecostomy. In acute complete obstruction and, on occasion, this procedure is supplemented with complete transverse colostomy. The latter type of decompression is particularly adaptable to extensive inflammatory reaction about the initial lesion. Although rarely necessary in the preparation of patients with cancer of the left colon, it is justifiable in doubtful cases and is essential in diverticulitis with obstruction or abscess formation. Complete colostomies are best managed by final excision of all scar tissue and an accurate end-to-end anastomosis with the bowel dropped free into the peritoneal cavity.

The added benefits of chemotherapy have doubtlessly played a role. Carefully controlled anesthesia, blood replacement, and better technical surgery have been the chief reasons for better results.

On admission, a patient with suspected cancer of the colon should have the following studies in addition to a careful physical examination and history. A plain film of the abdomen will often reveal the approximate site of the lesion by the gas pattern. This is true particularly when obstruction of any degree is present. If this fails to give a lead, one should then proceed with a careful sigmoidoscopy. If the lesion is not visualized, a barium enema must be used. The patient's anemia and electrolyte balance are evaluated and proper therapy is instituted to correct them.

Sulfathaladine is as effective in the preparation of the bowel for surgery as is sulfasuxidine. Occasional bleeding from the growth has not been noted when this drug was used but it was observed when sulfasuxidine was in use. The recent finding by Poth that sulfathaladine and penicillin are antagonistic must be borne in mind.

The early favorable changes observed following the removal of an infected, obstructing lesion are spectacular. Such aids as blood, plasma, and amigen appear more effective postoperatively, although the patient's ability to utilize an unobstructed gastrointestinal tract is probably the chief reason for this impression.

Incisions vary to some extent according to previous bowel drainage and the location of the tumor. In primary right colectomy a long right paramedian incision was found more satisfactory as this allowed adequate exposure of the vascular source and nodal spread. Transverse incisions are preferred for the flexures and lesions involving the midcolon. The left colon exposures have been paramedian in cases in which permanent colostomy might prove necessary. Oblique incisions with mesial retraction of the rectus muscle were satisfactory for low sigmoid tumors suitable for end-to-end primary anastomosis. Delayed primary wound closure was practiced with a minimal of wound infection.

Resection of the involved bowel and mesentery was wide on the cephalward side in all instances. In lesions of the left colon the distal segment has been adequate to include any extension of disease into the surrounding tissue. The bowel was divided between thin clamps in the proximal portion early in the procedure.

Instead of isolating the blood vessels to insure viability, the disease was removed and the adequacy of the blood supply to the end-to-end anastomoses was determined by visualization. Contact structures were removed with the primary tumor en bloc. These have included all the nonvital organs, or parts of them, within the abdomen and pelvis. The open method was used in all operations of election.

The rent in the mesentery is carefully closed on both sides when the anastomosis is completely within the peritoneal cavity. If pelvic dissection has been necessary, the lateral margin between the bowel and pelvic peritoneum is left open. This obviates the draining of this region through the ischial fossa, as formerly practiced. Fistula formation with resultant stenosis of the suture line is thereby avoided. Collections of serum in the hollow of the sacrum may burst into the peritoneal cavity with a transient intraperitoneal reaction. As a rule, however, seepage from this space is gradual and is adequately handled by the peritoneal cavity.

In suitable patients, dicumerol was used postoperatively to prevent venous thrombosis. However, many patients were arteriosclerotic or had other contraindications to the anticoagulant drugs. In these, prophylactic superficial femoral vein interruptions were practiced. If the lesion is well above the pelvic floor, this procedure can be done before, or at the time of, the bowel resection. If, however, pelvic dissection is necessary, then the vein interruption should be postponed for 48 hours after operation. There is a transient engorgement of the pelvic veins immediately following femoral vein interruption that definitely increases the blood loss during the pelvic dissection.

The average hospital stay in this series of cases was 32.4 days. The average number of postoperative hospital days was 6. There were 26 cases requiring preliminary bowel drainage or some 2 stage procedure. These averaged 39.9 days in the hospital, while those requiring no second stage averaged 24.8 days.

LEE PULLEN, M.D.

Management of Colostomies Performed for War Injuries. HALL G. HOLDER and EDWARD F. LEWISON. *Ann. Surg.*, 1947, 126: 253.

The authors report their wartime experience with 67 colostomies in patients treated by means of definitive surgery in an Army hospital in England, and draw a parallel between this experience and the current trends of colon surgery in civilian practice.

Colostomy closure in battle casualties presented many difficulties which are usually not encountered in civilian practice. First among these were the patients with multiple injuries. Such injuries frequently produced superimposed infections, concurrent sepsis, impairment of vital organs, and general debility. Also, the initial surgery was performed by surgeons in the forward area under the most difficult and trying conditions. Under these circumstances the exact construction of the colostomy was often not very clear to those who had to do the subsequent reparative work.

An analysis of the collected material reveals the site of injury to be as follows: right colon in 13 cases, transverse colon in 9, left colon in 15, rectosigmoid in 37, and rectum in 7 cases.

Despite the fact that the Army strongly recommended simple exteriorization as the operation of choice for large bowel wounds, the types of colostomy performed are cecostomy-11, double-barrel-(Mikulicz)-42, loop (exteriorization)-16.

The types of colostomy closure are tabulated by the authors and the preoperative, operative, and postoperative details of technique are outlined and discussed. The results were satisfactory in all but one patient who was evacuated to the Zone of Interior with a persistent fecal fistula.

The authors believe that in colostomy closure an end-to-end (either open or closed) anastomosis is preferable to the spur-crushing technique. In peacetime surgery, primary anastomosis of the colon is finding an ever widening circle of acceptance.

Emphasis is placed upon the surgical triad which, in the opinion of the authors, accounted for their satisfactory end-results: firstly, efficient therapy directed toward improving the patient's general condition prior to operation, secondly, the use of chemotherapeutic agents, and lastly, the operative care and improvement in surgical technique.

Colostomies, whether they be the result of battle casualties or commonplace conditions of the colon, should be closed at the earliest opportune time.

EDWARD F. LEWISON, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Biliary Ileus (Ileo biliar). FRANCISCO J. VIANO and LIDIO G. MOSCA. *Dia med.*, B. Air., 1947, 19: 1559.

Biliary ileus is an uncommon occurrence, as only 70 cases appeared in the Argentina literature and no more than 500 cases have been reported elsewhere. The authors report the cases of 2 patients 84 and 85 years of age, respectively. Both were cured.

In the mechanism of its production in the greater number of cases the calculus proceeds from the gall bladder and migrates through a cholecystoduodenal fistula; in a smaller percentage the migration is through a cholecystogastric fistula, and in a still smaller percentage migration occurs through the common bile duct. Biliary ileus is fundamentally mechanical, although one should also bear in mind the factor of intestinal spasm produced by pressure of the calculus. In the majority of cases these calculi have localized in the terminal end of the ileum, but they can be detained at any other point of the intestinal tract. The calculus may reach the dimensions of 3.5 cm. in width and 7 cm. in length while its shape may be spherical, oval, cylindrical, or conical. Spontaneous expulsion of the calculus is possible although infrequent.

The symptoms and signs usually found are as follows: pain is usually localized at the onset in the upper abdomen, right hypochondrium, or epigastrium; vomiting at first is gastric, then liquid and bilious, and later black and malodorous; there is stoppage of the intestinal gases and, later, distention.

The symptoms and signs not usually found are namely: palpable tumor formed by the calculus itself or by an afferent loop of bowel, hematemesis and melena, massive and sudden emptying of the intestine due to the peristaltic stimuli produced by the calculus, right lateral decubitus, disappearance of a palpable gall bladder, migration of pain with the calculus, hiccups, and vomiting of the calculus.

Evolution of the condition is as follows: it begins as a typical hepatic colic or pyloroduodenal stenosis; then there is a period of intermittent occlusion, a period of irreversible obstruction, and, last, a period of complications.

Roentgenologically, the condition may be diagnosed by direct localization of the calculus or dilated intestinal loops and by verification of the cholecystoduodenal fistua.

In spite of the facts that surgical intervention is simple, and that the circulation of the loop of bowel is not seriously affected, biliary ileus has the most severe prognosis and the highest mortality of all intestinal occlusions.

Once the diagnosis is made or suspected, surgical intervention should be immediate. The procedure of choice is enterostomy, the incision being made either over the calculus or directly above or below in the healthy bowel. The incision should be longitudinal, but should be sutured transversely. Anesthesia should be of the local type.

ARTHUR F. CIPOLLA, M.D.

MISCELLANEOUS

The Effect of Heparin upon Intra-Abdominal Adhesions in Rabbits. B. M. BLOOR, HUGH DORTCH, JR., T. H. LEWIS, R. F. KIBLER, and K. S. SHEPARD *Ann. Surg.*, 1947, 126: 324.

This is a report of an investigation on the effect of heparin upon the formation and reformation of ad-

hesions in rabbits. The adhesions were formed through a laparotomy incision by freeing and scarifying the antimesenteric border of the appendix. In the series in which heparin was used, 15 mgm. of heparin were placed in the abdomen at the time of the operation and a second peritoneal injection of 15 mgm. was given 24 hours after the operation. In some heparin treated rabbits Pitkin's menstruum was used.

The authors conclude from their investigation that the likelihood of developing adhesions was almost as great in the rabbits treated with heparin as in those that were not treated with this drug.

F. J. LESEMANN, JR., M.D.

Retroperitoneal Cysts. H. MINOR NICHOLS. *Ann. Surg.*, 1947, 126: 340.

A discussion of the various theories concerning the origin of primary retroperitoneal cysts is presented. The author also reports a case in which there was a palpable mass in the right lower quadrant of the abdomen; a differential diagnosis was made and the diagnosis of retroperitoneal cyst was made before operation.

Microscopic pathology revealed a diffuse irregular anastomosing series of tiny cleftlike and well formed channels lined by typical endothelial cells. The cyst was also in direct continuity with a large area of typical angioma.

An effort has been made to classify these cysts embryologically. In quoting the literature, one author states that there are approximately 500 case reports on omental cysts and only 18 on mesenteric cysts.

The variety of findings microscopically in the wall of the cyst is due to the fact that the tumor arises out of one of the many portions of the wolffian body.

A table is included in which 5 additional case reports not previously summarized are presented.

The diagnosis of retroperitoneal cyst is made by the process of eliminating other possible tumors. The treatment of this condition is entirely surgical.

Five illustrations are also included in the article.

RICHARD J. BENNETT, JR., M.D.

GYNECOLOGY

UTERUS

Investigations into the Uterine Mucosa. Pathologic and Clinical Classification of Metropathia Hemorrhagica. BERTIL FALCONER. *Acta obst. gyn. scand.*, 1947, 27: Supp. 5.

On the basis of endometrial biopsy the author divides cystic glandular hyperplasia into 4 phases, as follows:

Group I. Commencing or weakly marked phase. There is an abundance of glands which are crowded and show invagination and dilatation. The cells are high columnar and contain elongated nuclei, and localized stromal hyperplasia is present.

Group II. Cystic glandular hyperplasia with the microscopic picture of the classical hyperplasia.

Group III. Cystic glandular hyperplasia with secretory activity. The picture is characteristic of hyperplasia but with a varying amount of lutein stimulation which may be noted both in the glands and the stroma.

Group IV. Inactive or atrophic type. The glands are cystic but there is no evidence of glandular activity and the mucosa is thin and atrophic.

The author suggests that the condition may run a cyclic course like that of the menstrual cycle and that there is a definite correlation between the clinical symptoms and the microscopic findings. As to the etiology, he ascribes the major abnormality to ovarian dysfunction from abnormal function of the neuroendocrine system. J. ROBERT WILLSON, M.D.

Cervical Cancer: A Disordered Growth Response to Inflammation in the Presence of Estrogen Excess and Nutritional Deficiency. J. ERNEST AYRE. *Am. J. Obst.*, 1947, 54: 363.

During the course of studying vaginal and cervical cytology smears for a diagnosis of uterine cancer, it was observed that when cancer was present there was also cytologic evidence of abnormally high endogenous estrogenic activity. Recently a nutritional deficiency of thiamine was frequently found present in cases of abnormal estrogenic cornification. Three cases are presented in detail which demonstrate the combination of poor dietary habits and a low thiamine excretion level, increased cornification in the vaginal and cervical smear (high estrogen content), and the presence of an early cancer of the cervix as shown by both smear and biopsy.

With the hypothesis in mind that cervical cancer is a disordered growth response to inflammation in the presence of estrogen excess and thiamine deficiency, 100 cases were studied. Fifty patients had proved cervical cancer and 50 were controls who were in good gynecological health. Cervical smears were studied for estrogenic cornification. Thiamine excretion levels were determined. In a few cases liver function tests and urinary estrogen assays were made.

Some degree of chronic cervicitis is believed to be present in 4 of every 5 adult cervices. Eighty-two per cent of the patients with cancer had both a high cornification smear and a low thiamine excretion, while none of the controls had this combination. High cornification alone was found in 92 per cent of the cancer patients and in only 6.2 per cent of the controls. A low thiamine excretion alone was noted in 86 per cent of the patients with cancer and in 10 per cent of the controls. Only 14 per cent of the patients with cancer had a normal thiamine excretion, while this excretion was normal in 90 per cent of the controls. A normal or low estrogen cornification smear was found in only 8 per cent of the cancer patients but was noted in 94 per cent of the controls.

A 25 year old patient showing chronic cervicitis and a low thiamine excretion level was placed on stilbestrol in moderate doses over a period of 10 weeks. This was followed by vaginal spotting of blood, and cytology tests revealed cells of malignant morphology. Complete excision of the squamocolumnar circle of the cervix was made. Biopsy confirmed the presence of an early carcinoma. The cervix healed and no further change has been noted.

Thus partly by speculation and partly by interpretation of the evidence presented, an attempt has been made to correlate infection, excessive tissue estrogens, and nutritional deficiency in the production of cervical carcinoma of the squamous type.

JOHN R. WOLFF, M.D.

Cancer of the Uterus. EMIL NOVAK. *J. Am. M. Ass.*, 1947, 135: 199.

Uterine cancer is one of the most important of gynecologic problems. No less than 17,152 women in the United States died of this condition in 1944 (the latest year for which complete figures are available). Although great advances have been made, much remains to be accomplished.

Pathologists are still in the dark so far as the inciting factors transforming a normal into a malignant cell are concerned. They insist that cancer is a group of diseases, mainly because of the various histologic types found. Probably, however, a common denominator will some day be uncovered. Heredity certainly plays a role as does chronic irritation, whether the latter be traumatic, inflammatory or hormonal in nature. The traditional teaching is that cervical carcinoma arises in chronic irritative lesions of the cervix. On the other hand, carcinoma has been found in a normal appearing cervix. This suggests that in some individuals the genetic influence is so strong that the contributory effect of irritation is unnecessary.

Estrogenic hormones have been indicted as carcinogenic but it is difficult to eliminate *post hoc ergo propter hoc* reasoning in evaluating evidence on this

score. Estrogenic stimulation is of some importance, however, since patients with a history of functional menopausal bleeding, a delayed menopause, or postmenopausal endometrial hyperplasia have a higher than usual incidence of corpus carcinoma. It is advisable to avoid the use of estrogenic substances in women who, because of heredity or some other factor, have a suspected predisposition to this disease.

The term precancerous has two different meanings: (1) lesions chronologically preceding cancer, e.g., chronic cervicitis; and (2) what has been variously termed as preinvasive carcinoma, intraepithelial carcinoma, carcinoma *in situ* and Bowen's disease of the cervix. Most discussion centers around the malignancy of the latter interpretation of the term. Although the cells concerned are malignant in appearance, invasiveness has not yet occurred. Novak believes that preinvasive carcinoma is the beginning stage of cervical carcinoma and that this stage may be of extremely variable length. During this time the cancer is "benign" and is curable by simple excision. If a single biopsy shows preinvasive cancer, further sections of adjacent tissue will often show invasiveness.

In the body of the uterus one may encounter lesions which histologically present all stages between benign hyperplasia and adenocarcinoma. At times it may be almost impossible to differentiate microscopically the benign from the malignant. The author believes that hyperplasia in itself is benign, but when it occurs in a postmenopausal woman it predisposes to adenocarcinoma.

There are three more or less recent aids to the diagnosis of uterine cancer. Colposcopic examination as introduced by Hinselmann in 1927 is time-consuming and not very popular. The tinctorial test of Schiller suggests promising points for biopsy. The most heralded and promising diagnostic adjuvant is the Papanicolaou smear technique. Its main limitation is the necessity of its interpretation by trained cytologists. As a screening method in presumably normal women it will probably find its greatest field of usefulness. Biopsy and curettage still remain the most dependable means of diagnosis.

Previously, in treating cervical carcinoma the gynecologist merely decided (considering both the general and local condition of the patient) whether he was justified in operating. The personal equation was necessarily an important part of the decision. The primary mortality even with the most expert was high. Medical advances such as transfusion, chemotherapy and biotherapy were of course not available. Also, distressing sequelae, as ureteral and bladder injuries with and without fistula formation, were not infrequent. Radium was at first considered merely a palliative measure. It too was occasionally accompanied by serious injury to neighboring structures. Gradually, with more intelligent use it became apparent that radium was at least as effective as surgery. Immediate mortality is almost nil.

At present the trend in the therapy of cervical malignancy seems to be toward both radiation and surgery. Details vary but it is generally conceded that preliminary radiation lessens infection in addition to devitalizing and entrapping cancer cells in fibrous tissue. The surgical procedure may be a true radical Wertheim operation, a panhysterectomy including a large cuff of vaginal mucosa and a great portion of the parametrium, or merely a pelvic gland dissection. It is too early to completely evaluate the various methods but it should be emphasized that surgery is applicable to a small number of cases (in only 10 per cent of cases are the lesions of stage I).

Because of the slower extension of the lesion, the less radical operation required, the higher cure rate, surgery has always played a prominent role in the treatment of corpus carcinoma. At present, preliminary irradiation and then surgery are employed in the majority of clinics. The radiotherapy may be radium, x-ray, or both.

The author concludes that the surest and safest treatment of uterine carcinoma is prevention and, lacking this, early diagnosis. Unless the physician takes each case as a personal responsibility and conscientiously directs his patient to the best care available, the mortality from uterine cancer will not recede. Education of both layman and physician is vitally necessary. WARREN R. LANG, M.D.

Radium Therapy of Cancer of the Uterine Cervix and of the Fundus. ROBERT E. FRICKE. *Surg. Clin. N. America*, 1947, 27: 775.

Cancer of the cervix presents too complex a problem for the radiologist alone. The importance of early diagnosis cannot be overstressed. Once a malignant lesion is suspected, the patient is best seen at a clinic. Following a thorough general and pelvic examination, the patient is seen by the surgeon and the radiologist, and the best possible treatment for the individual case is outlined. Co-operation of the clinician, pathologist, radiologist and surgeon is essential.

The plan of radium treatment at the Mayo Clinic is defined as an intensive broken dose method. A 50 mgm. platinum-filtered tube is the unit of treatment and the average advanced lesion receives a total dose of 7,000 to 8,000 milligram hours throughout the entire birth canal in approximately eight applications in a period of 3 weeks. At the start treatments are applied twice a week and more rapidly thereafter, the exact interval depending on the visible response of the tumor.

The main principles of treatment are: (1) homogeneous irradiation of the entire birth canal by fairly short repeated treatments; (2) avoidance of trauma in probing the canal and inserting the tube; (3) use of the knee-chest position to secure adequate exposure and to avoid trauma during the necessary manipulations; (4) use of adequate gauze packing above the tube to increase the distance of the intestinal wall from the element, and (5) adequate follow-up studies of each patient over many years.

After the radium treatments, a supplementary course of roentgen therapy is given at 200 kilovolts

and with 550 roentgens measured in air to each of four fields, in the hope of sterilizing the parametrial regions. In stage 3 or 4 lesions, the course of roentgen therapy is repeated 3 months later.

A review of several hundred cases in which radium treatment was used showed that patients with stage 1 lesions had a 69.2 per cent 5 year survival rate; stage 2, 60.2 per cent; stage 3, 29.7 per cent; and stage 4, 6.5 per cent. These results concerned patients not treated before admission. Results in the "modified" cases in which the patient came to the Clinic after some treatment elsewhere were less satisfactory. This "modified" group formed a large portion—412 patients of the total of 1,491. Five year arrest of the cancer in stages 1, 2, 3, and 4 was 100 per cent (only 4 cases), 56 per cent, 19.8 per cent, and 4 per cent, respectively, of the patients treated. The 5 year survival rate of all patients, primary and modified, with cancer of all stages, was 26.8 per cent of the 1,352 patients traced.

During the first course of treatment, the main complications encountered in 5 or 6 per cent of patients have been due to spread of infection or to hemorrhage. All cervical cancers are infected when first seen; the topical application of bactericidal agents during the course of treatment clears up the majority of localized infections. Occasionally, however, pelvic cellulitis spreads, eventuating in a pelvic abscess or peritonitis. Cancer therapy is then stopped and measures are taken against the infection. The recent development of sulfonamide drugs and penicillin has undoubtedly cut down the treatment mortality rate, even though in former years this has averaged only 1 per cent. Once the spread of infection has been halted and the elevated temperature of the patient has returned to normal, cancer therapy may be resumed, sometimes after a rest period of 1 or 2 weeks.

In treating hemorrhage associated with cervical carcinoma, tight packing of the vagina with gauze every other day while proceeding with radium treatments will control the condition. After several radium treatments a few days apart enough connective tissue forms to stop the excessive bleeding. Hemorrhage is a serious complication. Some patients when first seen are so exsanguinated that transfusions and other supportive measures are necessary before cancer treatment can be started; anemic tissues also heal more slowly than normal tissues.

Complications which appear during subsequent visits of the patient are usually due to spread of the malignant lesion, uncontrolled by the previous radium therapy. They are usually due to lateral parametrial spread or to metastasis. One ureter may be occluded by the presence of cancer in the region of the broad ligament, and result in hydronephrosis and hydroureter, and finally in a nonfunctioning kidney. When both ureters are occluded, death from uremia ensues and is the most common cause of death in uncontrolled cervical cancer. When one kidney is functionless, palliative radium therapy may delay the fatal outcome. Other late complications are rectovaginal and vesicovaginal fistulas. Occasionally, delayed healing of tissues following radium therapy results in the formation of craters at the site of the cervix, covered with infected slough. The application of radon ointment to these craters has appeared to promote healing in several instances. Very occasionally, pyometra may be found; dilatation of the cervix with a rubber catheter and irrigation of the uterus with antiseptic solutions usually is effective.

These late complications are often seen in stage 4 lesions before any radium therapy has been given and they should be thoroughly studied. Whenever excessive pelvic infiltration is determined, excretory urograms and blood urea determinations should be carried out. Limited radium therapy usually affords some palliation in the presence of these late complications.

Because of the nature of cancer of the body of the uterus, characterized by slow growth and delayed metastasis, surgical removal of the uterus usually achieves a cure. Complete hysterectomy, not as radical or difficult an operation as the Wertheim hysterectomy, successfully eradicates the cancer.

Radiologists are interested in two groups of cases of this form of malignant lesion: those in which the lesion has extended widely before the diagnosis was established, so that surgical treatment is no longer feasible (stages 3 and 4), and those in which the lesion is still small but the patients themselves are poor operative risks because of other coexisting serious illnesses.

The underlying principle of treating cancer of the corpus uteri is, as with cancer of the cervix, homogeneous irradiation of the entire birth canal, employing the intensive broken dose method. Following the diagnostic curettage, two 50 millicurie radon tubes in tandem formation filtered with 0.5 mm. of silver and enclosed in a 1 mm. brass tube on a long copper wire are introduced to the depth of the uterine canal for 24 hours. With the patient in the knee-chest position, the applicator can be readily introduced with little trauma. The radon tubes fit into a narrow brass applicator; when radon is not available, two 50 mgm. tubes filtered with 1 mm. of platinum in a brass capsule of 0.3 mm. wall thickness are used. The wire is wound up in the gauze, which is packed above the cervix, filling the vagina and elevating the perirectal tissues to a safe distance. About a week later a second tandem is used, this time in the midportion of the uterus; it is placed by introducing the applicator to the depth of the uterus, then withdrawing it about 3 cm. and bending the wire where it emerges from the cervix. Again the two 50 millicurie radon tubes are left for 24 hours. If the uterus is very large, three tandems may be employed in different positions but with some overlapping; thus the interior of the uterine corpus receives from 4,800 to 7,200 millicurie hours in a period of 3 weeks. With two intrauterine tandems, the more usual treatment, at 1 cm. depth from the midline of the tubes the dosage varies from 5,200 gamma roentgens at one end of the applicator to between 12,000 and 24,000 gamma roentgens at the midpoint of the applicator, depending on the

amount of overlapping. In addition to the intrauterine treatments, a deep cervical canal treatment of 50 mgm. filtered with 1 mm. of platinum is placed for 14 hours, and two or three vaginal applications of 50 mgm. each, filtered with 1 mm. of platinum and 1 cm. of hard rubber, are placed across the face of the cervix and in the right and left fornix on different days, for 14 hours each.

The foregoing is a condensed description of a complete treatment given when the lesion appears to be small and cure seems possible. It is given in a period of 3 weeks; more than one intrauterine treatment a week is never applied. Cervical and vaginal treatments may be given in the interval. The radium treatment is followed by a course of high voltage roentgen treatment, 200 kv., 30 ma., 50 cm. distance, large fields, 550 roentgens per field for four to six fields around the pelvis, one field a day. The roentgen therapy may be repeated 3 months later in the more extensive cases.

In extensive lesions limited radium therapy, designed for palliation only, consists of the use of only one tandem and perhaps vaginal applications to shrink the growth and reduce pressure.

The results of radium treatment of cancer of the corpus uteri have been surprisingly good. Of course, the 5 year salvage depends on the percentage of stage 1 and stage 2 lesions referred for radium therapy. At the Mayo Clinic, the 5 year survival rate mounted from 12.63 per cent to 39 per cent when a greater percentage of less advanced lesions were treated. Study of the microscopic grade of the lesions yielded an interesting prognostic factor. Whereas in carcinoma of the cervix, in which the treatment can be individualized, the survival rate remained essentially the same for the different microscopic grades treated, in cancer of the uterine corpus, in which therapy is rather standardized, the grade was a very important prognostic factor; the 5 year survival rates varied from 79 per cent in grade 1 to 12 per cent in grade 4.

EXTERNAL GENITALIA

Relationship of the Vagina to the Adjacent Organs in Reconstructive Surgery. A Histologic Study. J. V. Ricci, J. R. Lisa, C. H. Thom, and W. L. Kron. *Am. J. Surg.*, 1947, 74: 387.

Specimens consisting of the perineal body, anal canal, rectum, vagina, urethra, bladder, cervix, and fundus were removed en masse from 22 cadavers (4 fetuses, 3 infants, and 15 adults). After fixation, some of these specimens were subjected to serial cross-sections, some to serial sagittal sections, and others to both, following an accurate longitudinal bisection. The purpose of the investigation has been to demonstrate microscopically all the tissues between the mucosa of the vagina throughout its entire length and the mucosa of all the juxtaposed organs such as the anal canal, the rectum, the urethra, and the bladder. Further, this investigation has as its purpose to prove or disprove the presence of a fascia variously designated, isolated, and utilized for reconstruction of the relaxed, sagging, and sacculating anterior and posterior vaginal walls. As a basis for discussion and classification of tissues, a fascia is considered a sheet of compact connective tissue of variable thickness, completely devoid of muscle substance, and possessing tensile strength for supportive and reconstructive purposes.

There is a complete fusion of the fibromuscular elastic wall of the vagina and the juxtaposed wall of the urethra throughout its entire length from the external urethral orifice to the trigone of the bladder. These two walls are closely integrated by interweaving strands of collagenous connective tissue and elastic fibers. No line of separation is present. But the portion closer to the urethral canal is more vascular than the portion closer to the vaginal canal. Between the urethra and the vagina there is neither cleavage plane, areolar zone, nor any substance remotely resembling a sheetlike structure of compact connective tissue, i.e., a fascia.

There is a definite line of separation, a cleavage plane, an areolar zone between the anterior vaginal wall and the juxtaposed wall of the bladder from the vesicouterine fold to the trigone. This line of separation is marked by the presence of loose shreds of areolar fibers. There is no substance betweeen the bladder and the anterior vaginal wall which in any way resembles a sheetlike structure of compact connective tissue, i.e., a fascia.

There is a complete fusion of the fibromuscular elastic structure of the outermost vaginal wall as it comes in contact with the short perineoanal canal. The point of fusion ends approximately where the anal canal continues as the rectum. Between this portion of the vagina and the perineoanal canal there is no cleavage plane, no areolar zone, no substance which in any way resembles a sheetlike structure of compact connective tissue, i.e., fascia.

There is a definite line of separation, a cleavage plane, an areolar zone between the posterior vaginal wall and the juxtaposed rectal wall, beginning approximately at the anorectal junction and ending where the rectum comes in contact with the cul-de-sac peritoneal reflection. The separation of these two organs is marked by the presence of loose shreds of areolar fibers. Between the posterior vaginal wall and the rectum, there is no substance which in any way resembles a sheetlike structure of compact connective tissue, i.e., a fascia.

The vaginal wall is a fibroelastic muscular structure with abundant connective tissue fibers. The muscular fibers are not separated into two distinct layers of inner circular and outer longitudinal, but consist of circular and longitudinal fibers of irregular distribution. It is only in the midportion of the vagina that the circular fibers give a suggestive pattern of a definite arrangement. In the same location both circular and longitudinal fibers are "stouter," particularly in the lateral and posterior portions. These muscle fibers become lost in that portion of the vaginal wall forming the fornices and the cervix.

Inferiorly, they also become lost around the introitus of the vagina and perineal body. The vascular components of the vaginal wall are abundant in the midportion and in the lateral portions of the vagina.

The mucosa of the anorectum is loosely attached by its submucosa; the muscles at the anorectal junction are intimately integrated into the perineal body. Above the perineal body the inner and outer muscular layer of the rectum are separated by an areolar tissue as loose in texture as the submucosa and as the areolar zone lying between the rectum and vagina. The muscularis of the rectum is extremely thin, becoming increasingly stout and compact as the rectosigmoid is reached.

The absence of an areolar cleavage plane between the anterior vaginal wall and the wall of the urethra, and the presence of a complete fusion of the fibromusculoelastic structure of these two organs, necessitates blunt dissection of the fibromusculoelastic structure to effect a separation between the urethra and the vagina. Separation of the fused layers of tissue of these two organs invariably leads to a manageable but unavoidable general ooze.

The presence of a definite line of separation, an avascular, areolar cleavage plane between the fibromusculoelastic vaginal wall and the bladder wall facilitates a clean cut anatomic and bloodless separation of these two organs if the operator enters the true avascular vesicovaginal space.

The absence of an areolar cleavage plane between the outermost portion of the posterior vaginal wall and the perineoanal canal and the presence of a complete fusion of these structures necessitates blunt dissection to effect a separation of this portion of the vagina. Separation of the fused layers of tissue of these organs leads to manageable but unavoidable general ooze and even brisk bleeding.

The presence of a definite line of separation, an avascular areolar cleavage plane between the posterior vaginal wall and the rectal wall, beginning approximately at the anorectal junction and ending where the vaginal wall fuses with the cervix and the rectum comes in contact with the cul-de-sac peritoneal reflections, facilitates a clean cut anatomic and bloodless separation of the rectum and the vagina, provided the operator enters the true avascular rectovaginal space.

There is no microscopic evidence whatsoever to substantiate belief in the existence of a so-called "fascia" between the urethra and the vagina, between the bladder and the vagina, between the perineoanal canal and the vagina, and between the rectum and the vagina, predicated on the basic concept that a fascia is a connective tissue sheet of variable thickness and possessing tensile strength. Such designations as urethrovaginal, vesicovaginal, pubocervical, pubovesicocervical, uteropubic, and rectovaginal fascias are gynecological misconceptions. And to dismiss the argument merely on the basis of a variation in terminology is a *reductio ad absurdum*. The gynecologist who "succeeds" in isolating these "indispensable fascias" for reconstructive purposes has split the fibromusculoelastic vaginal wall into two layers, the innermost of which he erroneously designates as a fascia. Since the microscopy of the areas in question shows none of these mentioned fascias, these designations should be stricken from the literature dealing with gynecological anatomy of the pelvis and that dealing with reconstructive vaginal plastic surgery. CHARLES BARON, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

A Rare Ectopic Pregnancy in the Left Cornu of the Uterus. ADOLF WIST. *Ann. chir. gyn. fenn.*, 1947, 36: 129.

The author reports a case in which a preoperative diagnosis of extrauterine pregnancy, a postoperative diagnosis of interstitial pregnancy, and a microscopic diagnosis of pregnancy developing in epithelial passages outside the tube, in the cornu of the uterus was made.

The history and findings were typical of an early ruptured ectopic pregnancy with the acute symptoms developing 45 days after the last normal menstrual period. At operation a defect was present in the left cornu of the uterus through which a small piece of placenta was presenting. The left cornu and tube were resected and the entire specimen was sectioned serially.

The tube showed no evidence of inflammation or endometriosis, nor was there a decidual reaction present. The cavity containing the embryo was situated deep in the muscle of the cornu and as it was traced a number of ductules lined by a tubal type of epithelium were present in the surrounding muscle. No communication between the tube or uterus and these ductules could be demonstrated.

The author discussed the various possibilities as to how the fertilized ovum reached its site, including the possibility of erosion from the uterine cavity, endometriosis, and salpingitis isthmica nodosa, and discarded them all on the basis of his microscopic findings. He concluded that the ovum had presumably passed to its final site along passages lined with tubal epithelium and opening into the proximal third of the inte stitial part of the tube. He did not demonstrate these connections. Perhaps this could have been a pregnancy which had reached its final site through an accessory tube. There were no sections made of the associated broad ligament.

GEORGE B. BRADBURN, M.D.

Studies in Rh-Isoimmunization in Pregnancy. MILTON S. SACKS, WILLIAM J. KUHNS, and ELSA F. JAHN. *Am. J. Obst.*, 1947, 54: 400.

Since August, 1945 the Rh typing laboratory of the University of Maryland, School of Medicine, Baltimore, has made observations on 12,275 patients in 1 year; 1,635 of the patients were Rh-negative, and among these there were 96 isoimmunized women.

Erythroblastosis fetalis occurred in the offspring of 53, or 67.1 per cent, of 79 isoimmunized women. Erythroblastosis fetalis was absent in the infants of 26, or 32.9 per cent, of this group. The fact was emphasized that the presence of Rh-isoimmunization was not necessarily synonymous with hemolytic disease in the offspring. This disease occurred once among 215 deliveries, an incidence of 0.46 per cent in the total group of 12,275 women studied.

Of the 96 isoimmunized women, 10 were primigravidas, and 86 multi gravidas. Six of the 10 primigravidas had a definite history of previous transfusions. In 48.8 per cent of the multigravidas, the initial evidence of isoimmunization occurred with the second pregnancy. Initial isoimmunization in the remaining 51.2 per cent was scattered from the third to the eleventh pregnancy.

Fifty-five patients were studied in an effort to correlate prepartum antibody titers with the outcome of pregnancy. When serum conglutination titers exceeded 10 units, a significant infant mortality was noted. In 40 patients who were studied by the plasma conglutination technique, significant infant mortality occurred only when the maternal titers were somewhat higher. A distinct correlation between the maternal serum titers and neonatal disease was demonstrated in most instances. The duration of the existence of the prepartum isoimmunized state, although of significance, was believed to be less important prognostically than the antibody titer.

The influence of labor on the antibody titer was studied in 19 patients. Eleven, or 57.8 per cent, showed a significant rise in titer.

Eighteen patients who were observed from 1 to 60 months post partum were demonstrated to still have antibodies in the circulating blood. The significance of this fact for transfusion and subsequent pregnancies is noted. JOHN R. WOLFF, M.D.

Toxic Complications of Pregnancy in Gorgas Hospital, Panama Canal Zone, 1931-1945. NEVIN S. SCRIMSHAW, GEORGE A. CULVER, and R. A. STEVENSON. *Am. J. Obst.*, 1947, 54: 428.

The present investigation is an analysis of the 10,000 pregnant patients delivered at the Gorgas Hospital in the Panama Canal Zone between 1931 and 1945. The records of the Gorgas Hospital afford an unusual opportunity to evaluate the influence of race, economic conditions, and a tropical climate on pregnancies under good prenatal care.

Three distinct groups of peoples populate the Canal Zone. There are the Panamanians, who are divided into the silver and the gold groups. The silver group is composed of the West Indian negroes and Panamanians whose income is limited by low, fixed standards; their housing is crowded, families are large, and life for them is a continuous economic struggle. The gold patients are Panamanians who are employed by the government and have a standard of living comparable to the Americans. The third group are the white Americans who have migrated to this area.

There has been a marked increase in the incidence of eclampsia in the Canal Zone during this period. This increase is a real one and is not due to changed standards of medical diagnosis. It is common to all the groups of people. No significant seasonal variations could be found.

There is a markedly higher incidence of eclampsia in negroes in Panama, which cannot be adequately accounted for by racial, dietary, therapeutic, or climatic factors. It is believed that adverse social and psychological factors affecting the negroes to a greater degree than the other population groups may be an important influence. JOHN R. WOLFF, M.D.

Further Observations on the Use of the Neutral Diet and Hydration in the Treatment of Toxemias of Late Pregnancy. RUSSELL R. DE ALVAREZ. *Am. J. Obst.*, 1947, 54: 445.

Patients with toxemia in late pregnancy are generally best managed in a conservative fashion. The essentials of this conservative management consist of hospitalization, bed rest, hydration, neutral diet, and ammonium chloride. The object of treatment is to return the involved tissues and organs to, and to maintain them in, as nearly a physiologic capacity as possible. The management of these patients is designed to treat the toxic manifestations already demonstrated and prevent additional ones.

It is imperative that treatment be instituted early in order to prevent progression of seemingly insignificant findings as well as to forestall latent sequelae. Bed rest and hospitalization are essential preliminaries for treatment. The neutral diet consists of foods which yield an equal amount of acid and alkaline ash, to which are added certain foods which yield an ash with no chemical reaction. The term "neutral diet" implies that the diet is salt free and sodium poor. The average diet contains about 2,100 calories daily. The protein content is maintained at from 85 to 100 gm. daily. Fluids are forced to a level sufficiently high to produce urinary excretion approximately equal to that of a normal individual. Fluids are supplied by mouth, parenterally, or by both routes if necessary, in order to insure a minimum daily urinary output of 2,000 c.c. Frequently, a daily minimum fluid intake of 4,000 c.c. is necessary to obtain a normal water balance. Ammonium chloride is administered to release the sodium ion from the tissues and to release the intercellular fluid retained by the sodium. It is given in gelatin capsules in order to insure complete absorption. The average dose is 45 gr. 3 times daily which is continued for 4 days. Sedation is used when needed.

When conservative methods fail to control pregnancy toxemia, termination of the pregnancy is effected by the most conservative means suited to the particular individual. The indications for cesarean section in toxemia patients should be essentially the same as in patients without toxemia.

JOHN R. WOLFF, M.D.

Chronic Hypertension and Pregnancy. F. J. BROWNE. *Brit. M. J.*, 1947, 2: 283.

Of all cases of toxemia of pregnancy, 25 per cent occur in women who before pregnancy begins are the subject of chronic hypertensive vascular disease. These cases are differentiated from the much more common pre-eclamptic toxemias (70% of toxemias) and the much rarer chronic glomerular nephritis in pregnancy (5%).

The standard of normal blood pressure is taken by the author to be 120/80, although other authorities have taken as normal an upper limit of 140/90. As a rule, blood pressure in normal pregnancies is lower than in the nongravid adult, particularly the diastolic pressure, and there is a greater pulse pressure. Other considerations of blood pressure are that: (1) it does not rise with age in normal persons but does in the potentially hypertensive; (2) a 10 year elevation of blood pressure above 120/80 is pathological; (3) transient rises in the blood pressure should be ignored; (4) 40 per cent of the population of the United States is actually potentially hypertensive.

In separating patients in the chronic hypertensive group from those in the pre-eclamptic group, the author places in the former group those patients in whom hypertension is discovered before the twentieth week of gestation, and in the latter those who are found to have hypertension after the 20 week borderline. He notes a definite familial tendency of hypertension in the former group, not in the latter. Clinically, the woman with chronic hypertension is somewhat older than normal (average age 30.2 years); she feels well and has no edema, albuminuria, or impaired renal function; her previous pregnancy has generally ended in stillbirth or abortion. During the second 3 months of gestation her blood pressure falls in a certain number of cases (40% in the author's series), a fact important in differentiating this condition from pre-eclamptic toxemia. However, the pressure rises again during the last 3 months, generally at the twenty-fifth week or later (54% of cases), but the mechanism of this last rise is not understood.

Clinical experience shows that when the blood pressure reaches 160 mm. systolic, albumin usually appears in the urine and the fetus is apt to die in utero (17.8%). The albuminuria is not itself the cause of fetal death, nor is there a renal toxin involved; rather, it is thought that both the albuminuria and fetal death are due to the same cause, i.e., vascular spasm, which causes albuminuria in the kidney and anoxia and injury to the vessel walls of the uterus and terminates in concealed hemorrhage.

Pregnancy should be terminated early if renal function studies show decided deficiency or if there is definite retinal arteriosclerosis, exudates, papilledema, or if there is persistent albuminuria; even with albuminuria alone which is noted before the twentieth week, intrauterine death is almost inevitable. The patient's reaction to rest is a guide to the continuation of pregnancy—if her pressure remains at 150/100 or over the outlook toward a favorable outcome is doubtful, but should it fall one may be optimistic. Every clinical therapeutic effort should be made to keep the blood pressure below the critical level of 160 mm. systolic, and this is accomplished by bed rest in the hospital and sedation. The use of potassium thiocyanate is suggested for the high levels but its results have not been satisfactory according to the author. The author emphasizes, how-

ever, that papilledema with or without retinal exudates is a primary indication for therapeutic abortion.

A natural delivery may be allowed if there is no serious exacerbation or if pre-eclamptic toxemia does not appear. If intervention is to be carried out, it is well to wait until about the thirty-seventh week (counted from the first day of the last menstrual period) when the fetus is viable and has a better chance of survival than if it is left in the uterus until term. Although cesarean section should generally be employed in cases of prematurity, induction and birth through the natural passages has its place in handling these cases.

The outlook for the child bears a definite relation to the height of the blood pressure at the start of pregnancy; the fetal mortality is around 60 per cent when the blood pressure is over 150/100 in the mother. However, if the blood pressure falls during the second trimester there is an excellent chance that a healthy child will be born at term.

Pregnancies exert no lasting deleterious effect on the patient with hypertension, although there is a much greater risk that eclampsia or pre-eclamptic toxemia may develop in the hypertensive patient. Although the patient does not actually benefit from pregnancy, pregnancy is not injurious provided the patient survives the immediate risks of the parturient; nor does pregnancy seem to cause any permanent aggravation of hypertension.

Comparative statistics by the author show that there is no significant difference between blood pressures in nulliparous and parous women in any age group. In fact, neither pre-eclamptic toxemia nor eclampsia per se cause chronic hypertension or bring out a latent hypertension earlier than it otherwise would have appeared. PHILIP B. CHASE, M.D.

Poliomyelitis in Pregnancy. ANTERO SETÄLÄ. *Ann. chir. gyn. fenn.*, 1947, 36: 117.

The author reviews the Scandinavian literature on acute poliomyelitis in pregnancy and lists 87 cases. He adds 15 of his own from Finland, and notes that the incidence of poliomyelitis has increased in the older age groups. Poliomyelitis was found to be more prevalent among males than among females, but there were more women, aged 20 to 40, than men among the reported cases for the entire country.

The expected incidence of poliomyelitis in pregnancy in the city of Helsinki, based on the birth rate and the total number of cases, is calculated, and the figures would predict an incidence of from 2 to 3 cases. Actually, 6 cases were discovered. A survey of the other reported cases, based on similar statistics, revealed that the actual incidence was three times that which was expected.

The pooled statistics indicated that most women with poliomyelitis in pregnancy suffered from the type that is associated with paresis. No difference could be observed in predisposition to the disease in the different stages of pregnancy. The prognosis was variable with the different authors reporting, and of 61 cases in which the prognosis was discussed there were 14 maternal deaths. In Setälä's series of 15 cases there were 5 deaths, 4 of these occurring in the latter half of pregnancy.

Because of the small number of cases, no definite conclusions could be reached as to the course of labor and the delivery, but it seemed to the author that the duration of the first stage of labor was not prolonged, and that only in patients with paresis of the abdominal muscles was the second stage prolonged beyond the usual expected duration. Postpartum hemorrhage did not occur in any of the cases in this series.

The intrauterine development of the babies appeared to be normal, and although the question as to whether the fetus can contract the disease in its intrauterine life is undecided, none of the babies had symptoms at birth, nor did they show evidence of it in the cases which were followed.

GEORGE B. BRADBURN, M.D.

Pregnancy Complicating Tuberculosis. C. J. BARONE, J. A. FINO, and L. H. HETHERINGTON. *Am. J. Obst.*, 1947, 54: 475.

The incidence of tuberculosis complicated by pregnancy at the Elizabeth Steel Magee Hospital, Pittsburgh, Pennsylvania, is 0.35 per cent. A review of 62 cases of tuberculous patients followed for a 5 to 15 year period is presented.

Of these 62 patients, 33.8 per cent are now dead, and of the latter 30.6 per cent died of tuberculosis.

Of those in whom the pregnancy was interrupted by abortion within the first 3 months, 38 per cent are now dead.

Of the 62 patients 61.5 per cent had moderately advanced or far advanced tuberculosis, and 44.8 per cent of the latter are now dead. All types of delivery, including therapeutic abortion were used. Of the patients subjected to cesarean section in order to terminate the pregnancy, 36.3 per cent are now dead of tuberculosis. The mortality for the patients who had spontaneous deliveries was 19.2 per cent.

The best results in this survey were obtained in those patients who delivered spontaneously, regardless of the extent of the tuberculosis.

JOHN R. WOLFF, M.D.

LABOR AND ITS COMPLICATIONS

Elective Induction of Labor. R. M. GRIER. *Am. J. Obst.*, 1947, 54: 511.

The elective induction of labor has long been a subject of much controversy. Some regard it as meddlesome and vicious. Others state that the membranes may be ruptured with impunity. In the past 10 years labor has been induced by choice in 1,353, or 12.9 per cent, of the women delivered at the Evanston Hospital, Evanston, Illinois.

The precipitation of imminent labor by rupture of the membranes can be very successful. The proper selection of cases is most important. The criteria for this proper selection are: (1) there should be no

cephalopelvic disproportion; (2) the baby should be mature and preferably present by the vertex; (3) the fetal head should be engaged or dipping well into the pelvis; (4) the cervix should be soft, partially effaced, and dilated to at least 1 cm.

The use of a dressing forceps rather than a sharp pointed perforator and its guidance through the vagina with a gloved finger in the rectum is the recommended method of rupturing the membranes to induce labor. The use of quinine and castor oil is potentially harmful, often inefficient, and certainly unpleasant. Calcium gluconate given intravenously has seemed to be a definite aid in producing normal and efficient uterine contractions. Pituitrin in more than 1 minim doses is not necessary. The usual technique of induction is to give a hot soapsuds enema, followed by 10 c.c. of 10 per cent calcium gluconate solution given intravenously. Within 2 hours, the membranes are ruptured artificially, as described. If labor does not ensue within 2 hours, pituitrin in 1 minim dosage is given intramuscularly at from 30 to 60 minute intervals. Usually, no more than 2 doses are required.

There was no mortality in these cases and the maternal morbidity was less than the general average for the past 10 years. The gross fetal mortality was less than 2 per cent, which is less than the general fetal mortality for the past 10 years. A physician is justified in making labor easier for his patient, provided he can accomplish it safely. The results here presented show that the elective induction of labor in properly selected cases, or, in other words, the precipitation of imminent labor, is a justifiable procedure. JOHN R. WOLFF, M.D.

Induction of Labor at the Chicago Lying-In Hospital. WM. J. DIECKMANN, and ROBERT B. MCCREADY. *Am. J. Obst.*, 1947, 54: 496.

When the termination of pregnancy is indicated after 32 weeks, the doctor must choose either cesarean section or the induction of labor. The latter would be completed preferably by vaginal delivery and rarely by cesarean section. Induction of labor is indicated in comparatively few cases as compared with 25 or more years ago when the cesarean section mortality was 10 per cent or more.

The primary consideration must always be: is the patient better off with the uterus empty? or, if the infant is alive and in good condition, are its chances of survival increased by early delivery? The indications for the induction of labor are selected cases of placenta previa, abruptio placenta, eclampsia, and nonconvulsive toxemia of pregnancy. The induction of labor for postmaturity, contracted pelvis, or the convenience of either the patient or doctor is contraindicated. In the hemorrhagic groups, the patient should be delivered vaginally if she possibly can be, without undue hemorrhage. In the patients with toxemia, one must evaluate the condition of the cervix, and severity of the toxemia. If the latter permits delay, the cervix will change and permit relatively safe induction of labor.

Rupture of the membranes is the simplest and safest means of inducing labor. Castor oil and quinine have no place in this technique. A vaginal examination with sterile technique should precede all attempts at induction. A careful evaluation of the pelvis, the determination of the presenting part, and the exclusion of a concealed prolapse of the cord, as well as the condition of the cervix must be determined. If the cervix is "ripe," labor can be successfully induced, and delivery completed within 24 hours in more than 80 per cent of the patients. The incidence of attempted induction of labor at the Chicago Lying-in Hospital, Chicago is 3.2 per cent, with a failure of induction in 9 per cent.

The induction of labor is inevitably followed by an increased maternal and fetal morbidity and mortality, irrespective of how carefully the cases are selected. JOHN R. WOLFF, M.D.

The Management of Prolonged Labor. HERBERT E. SCHMITZ, JAMES X. BREMNER, JANET E. TOWNE, and GEORGE R. BABA. *Am. J. Obst.*, 1947, 54: 643.

One of the most trying complications of pregnancy confronting the obstetrician is the management of prolonged labors. In this investigation, 24 hours has been selected as the limit beyond which the labor is considered prolonged. Labor was considered to be initiated with the onset of regular uterine contractions associated with pain, regardless of the presence or absence of effacement, dilatation of the cervical os, or rupture of the membranes.

In the 4 year period between July 1, 1942 and June 30, 1946, 5,599 patients were delivered at the Lewis Memorial Maternity Hospital, Chicago. Of these, 224 (4.0%) patients had labor exceeding 24 hours' duration. The cases excluded obstructed labor due to complicating tumor or disproportion, and were confined to those in which normal progress was expected but did not materialize. The authors believe that presentation and position do not materially influence the first stage of labor in the majority of the cases. They do, however, play a more important part in the second stage and its management; hence, the cases of brow, breech, and transverse presentations are included.

The routine procedure of management is based on extreme conservative care directed toward anticipating and combating infection and exhaustion during the antepartum phase, and maintaining a constant vigil for hemorrhage and shock during the postpartum phase.

As it is an established fact that the incidence of infection is increased as the duration of labor is lengthened, particularly after the rupture of the membranes, rectal and vaginal examinations are kept to a minimum. Every effort is made to avoid vulval contamination during rectal examination, and all vaginal examinations are made in the delivery room under strict aseptic technique.

Dehydration, starvation, and exhaustion are combated by the early institution of a dietary regime which includes small feedings of a soft diet every 4

hours. Liquid intake by mouth is encouraged. In the event that the patient is unable to retain food or liquid by mouth, 1,000 c.c. of a 5 per cent glucose in saline solution is administered twice a day or oftener, if indicated. Exhaustion is combated by an 8 hour period of rest alternating with a like period of labor. Morphine sulfate was the drug of choice in these cases as the barbiturates not infrequently caused excitation in the patient.

When labor has been in progress for 24 hours, the urine is examined every 6 hours for acetone and albumin and the fluid output checked carefully. In the event of the appearance of acetone and diacetic acid in the urine, with a rising pulse rate and signs of impending collapse, the patient is heavily sedated and placed on continuous fluids.

During the period following the sedation the labor usually progresses without stimulation. In a few instances in this series, intravenous calcium gluconate, quinine, and, rarely, small doses of pituitrin were used.

Delivery is not attempted in any case until the first stage is terminated and the cervix completely dilated. Major operative procedures are discouraged during the second stage unless the conditions and indications warrant interference.

Following delivery, the patient is kept in the delivery room under sterile drapes for a period of an hour. The blood pressure is checked every 15 minutes or oftener, if indicated. Early use of plasma and whole blood are encouraged. Intrauterine packs are used to control hemorrhage when needed, but such a procedure tends to increase the danger of infection.

The prolongation of labor is usually due to the prolonged first stage. The duration of the first stage is dependent on two main factors: (1) resistance of the cervix to dilatation, and (2) the all important intensity and frequency of the labor pain. Prolonged labor caused by cervical dystocia is usually due to congenital anomaly, severe scarring from previous trauma, or long standing infections with resulting fibrosis or scarring. In the authors' series, however, there was no instance in which cervical incision was considered to be indicated.

A definite increase of fetal mortality in prolonged labor as well as increased maternal morbidity was noted. There were no maternal mortalities. The elderly primipara group showed a higher percentage of prolonged labor than the younger group; it also showed a marked increase in the fetal mortality.

JOHN R. WOLFF, M.D.

Physiologic Changes in the Circulation during and after Obstetric Labor. ELLEN BROWN, JOHN J. SAMPSON, EDWIN O. WHEELER, BENJAMIN F. GUNDELFINGER, and JOSEPH E. GIANSIRACUSA. *Am. Heart J.*, 1947, 34: 311.

By means of various determinations of circulatory function, the authors seek to ascertain the effects of emptying the uterus, either by labor or cesarean section. That the work of labor is not alone the cause of cardiac stress is evident from the fact that deaths from congestive failure occur with as great frequency following cesarean section as after vaginal delivery. Because of the possibility that the pregnant uterus may function as an arteriovenous fistula of significant proportions, acute changes were sought that might indicate occlusion of such a fistula by delivery itself.

Serial observations, both intrapartum and postpartum, of changes in heart rate, arterial blood pressure, vital capacity, venous pressure, hematocrit values and plasma volume (using T-1824) were carried out on a total of 24 patients. These included patients both with and without cardiac disease, and patients delivered vaginally and by cesarean section without a trial of labor. Only the results of the last three mentioned studies were sufficiently uniform to lead to definite conclusions.

On the basis of the shunt hypothesis, a rise in venous pressure would be expected postpartum. Contributing causes, however, may consist of increased blood return from exercise and blood expressed from the uterus by oxytocic drugs. The increase in venous pressure was less marked following vaginal delivery than after cesarean section. It is postulated that during the uterine contractions of labor, intermittent increases of venous pressure produce filtration of fluid from the capillaries and therefore a gradual reduction of blood volume. To minimize the effects of increased venous pressure it is recommended that oxytocics be used cautiously in heart disease, especially in the presence of congenital intracardiac shunts.

Hematocrit and plasma volume estimations agreed with previous observations that (a) with delivery a significant quantity of fluid leaves the blood stream, (b) a volume equal or greater to this re-enters the vascular compartment on the second day of the puerperium or later, and (c) probably through diuresis the blood volume returns gradually to normal.

The authors conclude that, though not conclusive, their findings at least suggest that delivery of the fetus, either by vaginal or cesarean delivery, produces effects resembling those following obliteration of a large arteriovenous shunt.

WARREN R. LANG, M.D.

Shock in Obstetrics. W. A. SCOTT. *Brit. M. J.*, 1947, 2: 647.

The author states that the mechanism of surgical shock is as yet unknown, but clinically he has observed a group of cases characterized by hypotension, decreased blood volume, decreased cardiac output, and hemoconcentration which present a common clinical picture regardless of etiology. It is emphasized that these patients present a group of symptoms and not a disease, and that prevention and treatment are of primary importance.

The author states that in the urban centers there has been a great reduction in the number of maternal deaths due to shock in the past 25 years. The great majority of cases of obstetric shock can be attributed to hemorrhage. This was shown quite conclusively by

an analysis of the maternal deaths in the Province of Ontario, Canada, for 1943.

A review of 12,749 deliveries at Toronto General Hospital, Toronto, revealed 299 cases of postpartum hemorrhage with 6 deaths. The mortalities occurred in the patients with a blood loss of 1,000 c.c. or over, and death ensued within a period of 6½ hours from the time of birth. It is stated that most of these fatalities were due to errors in judgment.

The predisposing factors to the development of obstetrical shock are: excessive blood loss, labile vasomotor system, increased capillary permeability, and trauma. This is manifested clinically in the following obstetrical emergencies: postpartum hemorrhage, rupture of the uterus, and eclamptic toxemia.

The author states that the treatment of obstetric shock is prophylaxis. Any pre-existing, predisposing factors should be corrected upon recognition.

The active treatment of shock consists of immediate and complete relief of pain, maintenance of body heat, and the replacement of circulating blood volume by whole blood, if possible, otherwise the use of plasma or glucose solution is indicated; the bleeding should be controlled at its source. If surgery is indicated, it should be performed only after the shock has been corrected. J. ROBERT WILLSON, M.D.

PUERPERIUM AND ITS COMPLICATIONS

The Placental Stage and Postpartum Hemorrhage. WM. J. DIECKMANN, LESTER D. ODELL, VICTOR M. WILLIGER, ARTHUR G. SESKI, and RUSSELL POTTINGER. *Am. J. Obst.*, 1947, 54: 415.

Even in this "age of atomic energy" women still die of hemorrhage associated with parturition. Hemorrhage caused 30 per cent of the maternal deaths which occurred in the United States in 1944 and 1945. These deaths were either preventable or they occurred as the result of preventable factors. A marked reduction in the incidence of postpartum hemorrhage due to uterine atony will follow the proper conduct of the late second and early third stages of labor. The importance of a definite routine for the prevention and treatment of postpartum hemorrhage is stressed.

The prevention of postpartum hemorrhage is much easier than its treatment. Prevention begins with the proper conduct of the terminal phase of the second stage of labor. For a proper separation of placenta, it is of utmost importance that the baby be delivered slowly—in stages with a 30 to 60 seconds' pause after the delivery of each shoulder—which requires a total of at least 3 minutes. Thus, the uterine wall is given time to contract and retract, thereby tearing itself away from the placenta; the latter has usually separated within less than 1 minute. After the fetus has been expelled, as soon as the uterus retains its globular form it should be compressed but not pushed into the pelvis. When the placenta is in the vagina it should be extracted by pulling on the cord. Although an oxytocic is not necessary for the separation of the placenta under normal conditions, with patients under analgesia and anesthesia, one unit of a solution of posterior pituitary or 0.2 to 0.4 mgm. ergotrate should be injected intravenously after delivery of the posterior shoulder, if the doctor is experienced; if he is not, then after the delivery of the placenta. This will prevent excessive bleeding after the placenta.

If the placenta cannot be delivered and there is no bleeding, one may wait a maximum of 1 hour, but all retained placentas should be manually removed at the end of this time.

Uterine hemorrhage is treated by the immediate removal of the placenta, manually if necessary, or after the third stage by manual palpation of the uterine cavity and visual inspection of the vagina and cervix. One of the oxytocics mentioned above should be injected intravenously and repeated one time. If the bleeding continues, the uterus must be packed. A transfusion of 1,000 c.c. or more of blood, if necessary, must be given at once. Periodic hemoglobin or hematocrit determinations must be made.

JOHN R. WOLFF, M.D.

NEWBORN

New Methods in the Treatment of Asphyxia of the Newborn (Neue Methoden in der Behandlung asphyktischer Neugeborener). W. BICKENBACH. *Deut. med. Wschr.*, 1947; 72: 434.

In order to overcome the anoxia of the respiratory center it is important to supply the newborn with as much oxygenated blood as possible. The placenta represents a reservoir of oxygenated blood, and it has been shown that, under normal conditions, 51 per cent of the blood in the placenta flows through the cord within the first minute after birth. This amount and the rate of flow can be increased to 76 per cent and 30 seconds, respectively, by utilization of the force of gravity and by manual expression of the cord.

Immediately after birth, the newborn is grasped by the feet and is held head downward, as far below the level of the placenta as the length of the cord will permit. By this method of autotransfusion the blood volume of the newborn is increased by about 72 c.c., i.e., approximately one-fourth of the total blood volume. In the majority of cases, this technique alone is sufficient to start the respiration. The author was able to show that the hydrostatic pressure in the umbilical cord is increased considerably by this procedure.

In addition to this mechanical method, coramine or other analeptics may be injected into the umbilical vein about 10 cm. distal from the umbilicus. This should be done within 30 seconds after delivery because the circulation stops in most cases about 1 minute after birth.

The usual methods of artificial respiration are often unsatisfactory in asphyxia of the newborn because the lungs are atelectatic and the thorax is in the position of extreme expiration. Better results are

achieved by using the resuscitator which permits expansion of the lungs under positive pressure. To stimulate the respiratory center, from 3 to 6 per cent of carbon dioxide should be added to the oxygen.

WERNER M. SOLMITZ, M.D.

MISCELLANEOUS

Relationship between Erythrocyte Sedimentation Rate, Sludged Blood, and Plasma Proteins during Pregnancy. LESTER D. ODELL, GLORIA T. ARAGON, and RUSSELL E. POTTINGER. *Am. J. Obst.*, 1947, 54: 596.

The purposes of this article are: (1) to report the presence of "sludged blood" in women during both normal uncomplicated pregnancy and during pathologic pregnancies; (2) to report that the masses of agglutinated red cells are larger in certain of the pathologic conditions examined than in the uncomplicated pregnancies; (3) to point out probable relationships between (a) the intravascular agglutinations of the blood, (b) the increased in vitro sedimentation rates of blood from these patients, and (c) changes in the concentrations of certain plasma protein fractions.

It is stressed that rouleaux formation differs, by definition, from an intravascular agglutination of cells (or sludge). The former consists of an in vitro piling up of red cells, like coins, one on another; the latter, of in vivo intravascular cell aggregates wherein erythrocytes are held together at all angles to each other. The authors suggest that both phenomena relate to an increased cellular cohesiveness, and the nature of the substance causing this should become an object for much research.

A total of 52 pregnant and nonpregnant subjects were selected for study. These included 21 whose pregnancy was normal and 23 whose pregnancy was complicated, 16 with toxemia, 4 with thrombophlebitis and infection, 2 with acute hemorrhagic shock, and 1 with ectopic pregnancy. Nonpregnant controls numbered 8.

The lateral bulbar conjunctiva was viewed with a Leitz dissecting microscope. The size of intravascular masses and the degree in reduction of rate of flow were evaluated in fine, medium, and large venules and in arterioles. Sedimentation rates were estimated on the basis of these direct microscopic observations and were measured in vitro. Fibrinogen and total serum proteins were determined on the interferometer; albumin and globulin fractionization were obtained.

Observations by microscopy numbered 103; 77 of these are tabulated with simultaneously obtained sedimentation rates and plasma protein values.

Nonpregnant controls. In none of 6 female subjects studied whose sedimentation rates were below 24 mm./hr. was any intravascular agglutination of the blood observed. In 2 patients, whose diagnoses were pelvic inflammatory disease and generalized carcinomatosis, there were large, easily observable agglutinations within the venules and arterioles, a reduced rate of blood flow and, in some vessels, a temporary cessation of the flow; as anticipated, the sedimentation rates were high.

Normal pregnancy. Sludged blood, consisting of intravascular agglutinations of erythrocytes and reduced rates of flow with temporary cessation of flow in some vessels, was observed in all subjects with sedimentation rates of 33 mm./hr. or more. The largest cell masses and the greatest reduction in flow were seen in the patients who were near term, in labor, or early in the puerperium.

Pathologic pregnancy. In toxemia of pregnancy a noticeable narrowing of the arterioles could be detected in most of the patients. These vessels were not affected in normal pregnancy. In addition, intravascular agglutinations and reduced flow rates were observed. The sizes of masses comprising the "sludge" were larger, the rate of flow was considerably more decreased, and cessation of the flow was more prolonged, as compared with normal pregnancy.

Thrombophlebitis and infection. Identical evidences of sludged blood were seen. The sedimentation rates were unusually high in these patients.

Hemorrhagic shock. Three instances of severe hemorrhagic shock were observed, 2 in the same patient. Evidence of sludged blood appeared and was relieved by blood replacement therapy. Intravascular agglutinations were again noted after operative procedures with their attendant trauma. This appearance of sludged blood in the experimental animal has been noted.

Sedimentation rate. Conjunctival observations closely approximated the measured, uncorrected, hourly values. Values were higher at term, in labor, or during the puerperium, and highest in infections. In addition, the sedimentation rates of patients with pregnancy toxemia tended to be higher than those of women with normal pregnancy. There was close correlation with plasma fibrinogen values, less with albumin, globulin, or the albumin-globulin ratio, and no relationship with total serum proteins.

JOHN R. WOLFF, M.D.

Fetal and Maternal Mortality. N. S. ASSALI and L. F. ZACHARIAS. *Am. J. Obst.*, 1947, 54: 651.

This article represents a compilation of the data collected in a survey covering an 11 year period from January, 1935 through December, 1945, at the Department of Obstetrics, Bethesda Hospital, Cincinnati, Ohio. The 11 years are considered in two periods, the first from 1935 to 1940, and the second from 1940 to 1945.

Deliveries by general practitioners predominated in the first period. This period was also characterized by abuse of cesarean section, the use of high forceps, and lack of control of the obstetric procedures. In consequence, a high fetal and maternal death rate was noted.

Although obstetricians continued to deliver a relatively small proportion of the patients at the outset of the second period, significant modifications in pol-

icy occurred. Rigid rules were established by the Obstetrical Committee regarding the performance of cesarean section and the use of the high forceps. Frequent utilization of obstetric consultants was required, and supervision of the delivery was instituted. These changes brought about definite improvement in standards of practice, with consequent decrease in maternal and fetal mortality. The improvement has been increasingly evident in the latter years of this period.

In the hands of the obstetric staff, breech delivery has received particular attention in recent years. Increasing emphasis on external version and careful roentgenologic study in cases of breech presentation have made possible accurate determination of cephalopelvic disproportion with consequent reduction in the number of unnecessary cesarean sections. In addition, the use of the bag for dilatation of the cervix and routine episiotomy have made breech delivery less traumatizing.

Despite the continued efforts of obstetricians and pediatricians, little has, as yet, been accomplished in the reduction of mortality attributable to prematurity. It is the authors' hope that by the more extensive employment of the procedures and principles noted concerning breech delivery, plus more circumspect use of maternal sedation, constant use of pediatric consultation, and improved management of toxemia, the mortality among premature infants will be reduced.

Fifteen thousand and eighty-eight deliveries occurred during the 11 years of this report. For the entire period, the gross fetal mortality was 4.5 per cent, and the corrected mortality 3.5 per cent. Although the results have been improved in the more recent years, these figures still remain high.

Breech and version delivery resulted in the highest, and low forceps delivery in the lowest, fetal mortality rate.

The fetal and maternal mortality among deliveries by general practitioners was higher than that of obstetricians.

Prematurity was the major fetal contributing factor and toxemia the major maternal factor causing fetal death.

The gross maternal mortality was 0.18 per cent and the corrected, 0.17 per cent. It has steadily decreased throughout the past few years, during which time it has ranged between 0.10 and 0.13 per cent.

Hemorrhage and shock, infection, toxemia, and heart disease were the major causes of maternal deaths.

JOHN R. WOLFF, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

The Suprarenal Cortical Syndrome. WILLIAM L. MCLAUGHLIN, JOHN P. BOWLER, and JARRETT H. FOLLEY. *J. Urol.*, Balt., 1947, 58: 221.

The suprarenal cortical syndrome is defined as the sum of metabolic changes produced in the body by the presence of an excessive amount of adrenal cortical steroids. This excess of steroids may be the result of hyperplasia of the adrenal cortex brought about by the adrenotropic hormone of the pituitary gland, or a primary tumor of the adrenal cortex.

The authors presented a patient with a clinical picture of suprarenal cortical syndrome that was produced by carcinoma of the right adrenal gland. Following the extirpation of this neoplasm the patient developed a state of adrenal insufficiency which resulted in a slow but complete recovery.

Without identifying the type or types of excess steroid the authors stated that their patient's adrenal cortical neoplasm produced steroids of considerable biologic activity. ROBERT TURELL, M.D.

Ureteral Transplantation and Cystectomy. VICTOR F. MARSHALL. *J. Urol.*, Balt., 1947, 58: 244.

Transplantation of the ureters and total cystectomy is a surgical procedure of considerable magnitude which carries a postoperative mortality of at least from 10 to 20 per cent. Radiation therapy for bladder cancer carries a much lower immediate mortality, so that before advising the surgical program the surgeon should have some definite reasons in mind.

First of all, how effective is radiation in the treatment of bladder cancer? Three hundred consecutive bladder cancer records at the Memorial and New York Hospitals from 1932 to 1938, inclusive, were reviewed in detail. Papilloma was excluded, and it must be stressed that the pathologists' criteria were very strict, excluding from the cancer classification even atypical papillomas which are commonly considered of low grade malignancy. Only 52 patients, or 17 per cent, were known to have survived 5 years and only 27 (9%) of these could be called free of cancer 5 years after the diagnosis. These 27 patients, representing 5 year successful results, will not all stand as "cured" upon critical review as at least 5 created some doubt in regard to the diagnosis of cancer, at least 5 were in poor condition at the 5 year anniversary, and at least 5 died subsequently without a reliable record of the cause of death being obtained. Furthermore, 3 were clinically free of disease because cystectomy had been done after the failure of radiation therapy. All points considered, it would be reasonable to say that by the author's radiation methods of the 1930's the 5 year successful result rate was approximately 6 per cent. The average survival was 24.5 months for a group of 316 patients with a complete follow-up of 3 years or more. This hardly compares favorably with results of nontreatment as reported elsewhere in which the average survival was 18.8 months and approximately 10 per cent of the patients survived 5 years.

The simplest surgical treatment of bladder tumors is local destruction by fulguration. On review of the author's old and recent records, very few good results were obtained by this method, and the overwhelming majority of tumors proved to be no more than papillomas histologically, and not cancers, especially when the result was not obviously a failure. Most of the few good results were obtained when small, well localized, and low grade lesions were present, but there were so many apparently similar cases which resulted disastrously that the criterion for choosing candidates was not evident. Few internal cancers are cured by simple local destruction and a complete follow-up on histologically proved bladder cancer indicates no major exception in the author's experience.

Thirty-three bladder resections done within the past 5 years have resulted already in 11 known recurrences in the bladder and 3 postoperative deaths. Twelve of the 33 patients are now known to be dead. Even so, the average survival was 20 months in spite of the fact that the follow-up was necessarily less than a year in 14 cases, and less than 2 years in 17. Several patients have had excellent results thus far, but the impression is unavoidable that in the anxiety to preserve bladder function and avoid more immediately hazardous surgical procedures resection was done on lesions which were too large, on lesions in which the margin of removal was necessarily small, and on lesions with a tendency to multiply within the bladder.

Total excision of the bladder is usually not a difficult or dangerous operation in itself, as was shown by the occurrence of only 2 deaths in more than 77 cases, a mortality of 2½ per cent or less. However, the real surgical problem is the satisfactory permanent diversion of the urinary stream prerequisite to cystectomy. Transplantation of the ureters to the skin is a relatively simple procedure, and in the author's experience almost all postoperative deaths could be obviously attributed to the patients' poor preoperative condition. Stricture and abscess formation associated with indwelling ureterostomy catheters become more common the longer the follow-up is continued. Occasionally calculi have developed. Ureterostomy cups without catheters seem better than catheters for preventing these complications but only a few patients can and will manage them. At best, the patient must wear a cumbersome and untidy apparatus, and at the worst, the patient will be physically miserable and socially unacceptable. If the ureters are transplanted to the bowel above a normal anal sphincter the patient does not need an apparatus, is socially acceptable,

and, except for the necessity of sitting to urinate, which half the population does naturally, appears outwardly normal. However, the problem is not simple because the immediate and late risks of ureterointestinal anastomosis are not only greater but are usually of more grave importance after skin transplantation.

The author transplanted the ureters to the bowel in 104 patients by the Coffey I intraperitoneal method. Thirteen deaths resulted, a mortality of 12.5 per cent. Two patients died of peritonitis from leakage and 1 from small intestinal obstruction at the operative site. This 2.8 per cent represents the only postoperative mortality due to complications in the peritoneum, the urinary tract, or the gastrointestinal tract. Of the remaining 10 deaths, 3 were due to congestive cardiac failure, 3 to embolism, 3 to carcinomatosis, and 1 to the effects of a radical operation on a recurrent urethral carcinoma. The author emphasizes the fact that this series includes palliative cases and that only 8 patients had transplantation for conditions other than neoplasm. The oldest patient was 83, and 7 were in the 70's. Thirty-three, including the 13 just mentioned, are known now to be dead and 71 are living from 1 to 56 months. Temporary nephrostomy was necessary on 3 patients and 1 other patient is now carrying nephrostomy tubes during convalescence from cystectomy. One nephrectomy was necessary. One ureter was successfully implanted into the bowel a second time. Three patients had one or both ureters transferred from the bowel to the skin because of poorly functioning ureterointestinal anastomoses. In brief, of the 207 ureteral transplantations to the bowel, 26 were unsuccessful because of the postoperative death of the patient; 1 was unsuccessful as nephrectomy became necessary; 5 were failures because the ureter was necessarily transferred to the skin; and 2 at this time must be called failures because the patient is wearing bilateral nephrostomy tubes. The second implantation of one ureter was only a partial failure as the second attempt remained successful over a year later. Thus, of 207 transplants 34 were immediate failures but 173, or 84 per cent, were early successes.

JOHN A. LOEF, M.D.

BLADDER, URETHRA, AND PENIS

An Artificial Sphincter. FREDERIC E. B. FOLEY. *J. Urol.*, Balt., 1947, 58: 250.

In true incontinence there is escape of urine through an anatomically or neurologically incompetent sphincter. With complete incontinence the bladder is always empty. With incomplete incontinence the bladder partially fills and the urine which is excreted into the bladder in excess of "continent capacity" is not retained but escapes through the urethra.

Anatomic incompetence of the urethral sphincter is usually the result of trauma: obstetric, surgical, or otherwise. Neurogenic incompetence of the sphincter is due to organic disease of the central nervous system, injury, or anomaly causing permanent relaxation of the external sphincter. In females, incontinence may be caused by "idiopathic" relaxation of the sphincter which is not of traumatic or neurogenic origin.

Control of incontinence in the new way presented by the author is accomplished by a very simple mechanical device which functions pneumatically. The device has been called "an artificial sphincter." It is applied to the urethra which is compressed by air to prevent the escape of urine.

The artificial sphincter may be applied to the urethra in its normal anatomic relationships or to a segment of urethra surgically isolated from adjacent structures by a new operation which has been called a cutaneous tunnel operation.

The artificial sphincter consists of a pneumatic or inflatable incontinence clamp which compresses and occludes the urethra, and an inflating device communicating with it by means of an air passage of rubber tubing. The device is carried in the pocket of the trousers.

The purpose of the cutaneous tunnel operation is to permit application of the pneumatic incontinence clamp to an isolated segment of urethra without encirclement and constriction of the rest of the organ, particularly the cavernous bodies, to the end of avoiding engorgement and partial erection distal to the site of application. This form of application permits maximal effectiveness in occluding the urethra by a clamp of minimal size requiring the smallest possible displacement of air. JOHN A. LOEF, M.D.

Exudative Cystitis. J. V. BERRY and N. E. BERRY. *J. Urol.*, Balt., 1947, 58: 260.

In a series of 24 cases of acute exudative cystitis, a few cases were complicated by arthritis, conjunctivitis, iritis, and dermatitis.

The acute vesical syndrome is characterized by a profuse abacterial pyuria and gross hematuria. The end-result of the inflammatory lesion is a contracted and ulcerated bladder with terminal ureteritis and marked dilatation of the upper urinary tract.

The authors believe that the condition is caused by an organism, possibly a spirochete, and that it has some relation to nonspecific urethritis.

The differential diagnosis concerns the exclusion of gonorrhea, tuberculosis, and malignancy. Familiarity with the symptoms and the urographic findings makes the diagnosis simple.

Characteristically, the whole picture can be reversed in a short period of time with specific treatment; usually the neoarsphenamines are employed. Mapharsen, in the experience of the authors, has been equally efficacious. JOHN A. LOEF, M.D.

The Treatment of Serious Tumors of the Bladder. R. OGIER WARD, ARTHUR JACOBS, H. P. WINSBURY-WHITE, DAVID BAND, and Others. *Brit. J. Urol.*, 1947, 19: 144.

In this symposium it was attempted to assess the relative values of partial and total cystectomy.

WARD classified bladder growths as papillomas, both "potentially" benign and "potentially" malignant, and carcinoma divided into infiltrating and noninfiltrating papillomatous types, nodular and ulcerative types, and adenocarcinomas. In potentially malignant papillomas he gives cystoscopic fulguration (diathermy) a trial first. In true carcinoma, when partial cystectomy is employed, he removes the entire growth together with a wide margin of mucosa and the entire thickness of the bladder wall. Reimplantation of the ureter into the bladder is done whenever necessary. The worst results occurred in nodular infiltrating carcinoma. Possibly the growth was not removed widely enough (with sufficient margin of apparently healthy tissue). Excision should be done with a diathermy knife. Another cause of failure is the failure of recognition of extensions outside of the bladder in the adjacent tissue. In open operations upon papillomas reimplantation of pieces of tumor may occur. Iliac lymph nodes may already be involved at the time of operation. Distant metastases may be present. Ward palpates the liver through the opened peritoneum in each case. He thinks that total cystectomy is most effective in cases of malignant papilloma and much less effective in nodular or ulcerative growths. If a wide excision is impossible in attempting partial cystectomy, the operator must go further and perform total cystectomy, whatever its disadvantages and imperfections. Deep x-ray therapy after radical operation is useless.

Preoperative accurate diagnosis should include accurate estimation of the size and appearance of the growths cystoscopically, possibly by insertion of a graduated ureteral catheter alongside the tumor. The posterior urethra should be inspected. A cystogram outlines large growths well. Excretory urography demonstrates ureteral obstruction and possible renal tumor. Bimanual examination under anesthesia is very important. A search for distant metastases is necessary. Cystoscopic biopsy should be done whenever reasonable. At operation the liver should be palpated, the extravesical extent of the growth estimated, and the regional lymph node area should be examined. Ward suggests that when the partial cystectomy is completed, a further small piece of adjacent mucosa and muscle in apparently healthy areas should be removed for examination. A pathologist should be present at the operation.

JACOBS employs segmental bladder resection only when the size and situation of the growth permits concomitant excision of a wide margin of healthy tissue, as in tumors in the middle and upper zones of the lateral and posterior walls and on the superior wall. Tumors of the base or lower lateral walls are treated by open operation and insertion of radium. Good long term results are expected only when the tumors are of the papillary type. In advanced infiltrative growths total cystectomy is not worth while.

WINSBURY-WHITE employs interstitial implantation of radium needles. He found considerable lack of vesical irritation in cases of long survival.

BAND believed that total cystectomy was the operation to be aimed at. An infiltrated organ should be extirpated, and if the tumor is not removed toxic absorption makes the patient gravely ill.

GALBRAITH believes that a cure is not a matter of 5 years but of from 15 to 20 years. Frequent follow-up cystoscopy has been employed in his clinic for several years, with annual cystoscopy for at least 5 years thereafter. Small growths are fulgurated in the outpatient department without anesthesia. Low spinal anesthesia is used in large tumors and difficult cases. A patient unsuitable for transurethral treatment is hospitalized and treated by open bladder fulguration. Partial cystectomy is employed for ulcerated or infiltrating tumors. Radium needles are employed in selected cases. All radiation therapy is guided by a radiologist.

BERNARD WARD performs extensive fulguration on papillary growths. He prefers early cystectomy on primary ulcerating malignant growths. When infiltration of the base is rectally palpable, the growth is inoperable.

TAIT (Australia) urged the active co-operation of the radiologist when radium is employed. Partial cystectomy is employed when the growth is not large.

MACK uses radium frequently even when a papilloma is fulgurated and the bladder wall at the pedicle base seems normal. Infiltrating tumors are thoroughly removed with the diathermy loop, the base is fulgurated, and 0.5 or 1.0 mgm. radium needles are inserted at the tumor periphery. They are subsequently removed (usually in 7 days) through the suprapubic wound by withdrawing them with the attached linen threads. The suprapubic catheter remains in place for 3 weeks.

Total cystectomy is decided upon only after inspection of the growth in the opened bladder. If total removal is indicated, the bladder is closed around a suprapubic tube, one ureter is transplanted, and the bladder is removed when the other ureter is transplanted in a few weeks.

ROCHE stated that loin pain associated with bladder tumor suggests ureteral obstruction, usually by carcinoma rather than papilloma. In performing partial cystectomy he has ligated the ureter rather than reimplanted it.

WADE used free wide excision, without fear, when performing partial cystectomy.

POOLE-WILSON suggested the use of radioactive fluid to prevent recurrences of bladder tumor in dye workers.

In summing up, the discussion disclosed differences of opinion about (1) the desirability of general anesthesia for cystoscopic fulguration, (2) the wisdom of opening the bladder before deciding on treatment (danger of dissemination), and (3) the relative value of surgery and irradiation. There was general agreement about (1) the need for early cystoscopy and repeated follow-up, (2) the difficulty of deciding whether a growth was benign or malignant, (3) the necessity for combined treatment, and (4) the belief that total cystectomy had its greatest field of use-

fulness in the more extensive but less malignant papillary tumors. DAVID ROSENBLOOM, M.D.

Transurethral Resection in the Treatment of Vesical Dysfunction Secondary to Inflammatory, Degenerative and Traumatic Lesions of the Spinal Cord. JOHN L. EMMETT and J. E. BISQUERTT. *Surg. Clin. N. America*, 1947, 27: 950.

Prather suggested that the proper treatment of the acute phase of vesical dysfunction resulting from lesions of the spinal cord should consist of continuous drainage provided either by an indwelling urethral catheter or a suprapubic cystostomy tube. When these methods are used, the bladder is kept clean by means of a closed system of irrigation by either the intermittent or automatic (tidal) method. The choice of urethral or suprapubic drainage depends on various factors, among which are: (1) the facilities available for the care of the patient, (2) the type of nursing service, (3) urethral tolerance, and (4) the length of time drainage is expected to be necessary. Some patients are able to tolerate an 18 F. bag urethral catheter for long periods with no untoward results. In other cases, there is a tendency for urethral infection and periurethritis to develop; these complications may result in periurethral abscess (usually at the penoscrotal junction) and fistula. It is important to avoid such complications if possible, as they greatly complicate treatment in the chronic stage. Administration of small doses of one of the sulfonamide drugs while a urethral catheter is in place will assist in the prevention of such complications. Each case must be considered individually, however, and final decision is a matter of keen judgment on the part of the physician.

The matter of the closed system of irrigation is important. Munro and Hahn have advocated the automatic (tidal) variety of irrigation. They and other authors have demonstrated that the urine may be kept free of infection for long periods of time with this type of treatment; however, their assertion that tidal drainage will prevent hypertonicity and spasticity of the bladder in the chronic stage has not been substantiated by other authors.

The therapy of the chronic stage of the neurogenic bladder is primarily a problem involving the treatment of various types of hypertonic cord bladder. Almost the only exception to this statement is the atonic tabetic bladder. Vesical dysfunction in the tabetic patient responds well to transurethral resection of the vesical neck.

The remaining consideration, therefore, will concern the various types of hypertonic neurogenic bladders which constitute the overwhelming majority that are the end-result of lesions of the spinal cord.

A total of 65 patients with chronic cord bladder have undergone transurethral resection at the Mayo Clinic prior to January, 1946. Forty-five of these patients had transverse lesions of the spinal cord, while the remaining 20 had other lesions of the spinal cord, such as multiple sclerosis, combined sclerosis, and miscellaneous lesions.

All of the transurethral resections in this series of cases were done with the Thompson cold punch with the usual technique. The object of the operation is to remove the vesical neck (so-called internal urethral sphincter) and any prostatic enlargement that is present. The resection must be complete and should be carried out to the region of the external urethral sphincter. If the external sphincter is not damaged, incontinence will not result. The resection must frequently be done in multiple stages. Although the surgeon may feel sure that the resection has been complete, he will often find on subsequent examination that as much or more tissue can again be removed. It is wise to perform the resection in multiple stages in some instances because, if one tries to resect too deeply in the muscular tissue at the vesical neck at the first stage, troublesome bleeding may be encountered and may prove difficult to control. In the 45 cases of transverse lesions, the resection was done in one sitting in 34 cases, in two stages in 7 cases, in three stages in 2 cases and in four stages in 2 cases. The amount of tissue removed is usually rather small unless the patient is an elderly person. However, young patients in whom the cord lesion has been present for many years may have a large amount of hyperplastic tissue at the vesical neck. In the series of 45 cases under consideration, the amount of tissue removed varied from 1 to 34 gm.

The results of transurethral resection in these 45 cases were gratifying. Excellent results were obtained in 32 cases; in 7 cases, the patients were greatly improved; in 2 cases fair results were obtained and in 4 cases the patients were unimproved.

Surgical treatment should be postponed until the patient is in good general condition and until the decubitus ulcers are well controlled. It would also be desirable to await some return of vesical tone. Whether or not one should wait longer than 3 or 4 months for this to occur is doubtful, however.

The results of transurethral resection in cases of multiple sclerosis have not been as consistently good as the results in cases of transverse lesions of the spinal cord. Three patients obtained good results, and in the other 4 cases the results were only fair. Resection was done only once in each of the 4 cases in which the results were fair; therefore, it is entirely possible that further resection might have been beneficial, as is so often true in cases of transverse lesions.

Transurethral resection was performed in 5 cases of combined sclerosis and the results were good in 4 cases. Of the remaining 8 cases, the results of transurethral resection were good in 5 and poor in 3 cases.

Primary Carcinoma of the Male Urethra. JERRY ZASLOW and JAMES T. PRIESTLEY. *J. Urol.*, Balt., 1947, 58: 207.

Twenty-five cases of primary urethral neoplasm have been encountered at the Mayo Clinic from 1910 to 1945, inclusive. The diagnosis was established by microscopic examination in all but 3 of these cases. In all of the cases studied histologically the diagnosis was epithelioma. No adenocarcinomas of the glands

of Littre were encountered. Cases of adenocarcinoma in the posterior urethra have not been included.

The growth was situated anteriorly in 10 cases and posteriorly in 14, and in 1 case both the anterior and posterior urethra was involved, a proportion in accord with reports in the literature. There was little difference in the symptoms and clinical characteristics regardless of the location of the growth; however, the most common initial symptom for an anterior lesion was difficulty in micturition, whereas for a posterior lesion hematuria was most often the presenting symptom. If a growth is of appreciable size it can be palpated, especially if it is located in the anterior urethra. Six of the 25 patients presented a history of urethral stricture prior to the onset of symptoms referable to the neoplasm, an incidence which seems somewhat more than coincidental. The average age of the patients was 56 years and the youngest one was only 28 years of age. The grade of malignancy was determined in 20 cases and in 19 was either 2 or 3.

Treatment varied according to the location and extent of the lesion. In the 10 cases in which the growth was located in the penile urethra, amputation, radium, and fulguration were employed with equal frequency. Amputation, which may be partial rather than complete, is preferable for the more extensive lesions. It is well to remember, however, that a partial amputation which leaves virtually no urethra which may be grasped during micturition to direct the stream may be more of a handicap to the patient than a perineal urethral meatus which can always be used satisfactorily in the sitting position. For a relatively small growth in the region of the fossa navicularis, radium may be applied directly. Fulguration can be used to destroy a relatively small lesion. If there is any doubt regarding the complete destruction of the growth *in situ* by either of these methods, amputation would seem the treatment of choice.

Treatment of an epithelioma situated in the membranous or prostatic urethra is somewhat more difficult. In the present series of cases, prostatectomy, cauterization, application of radium, transurethral removal and fulguration, and roentgen therapy were employed. Obviously, there must be individualization in the choice of treatment, according to the exact location and extent of the lesion. Experience has been too limited to permit general conclusions but obviously the same principles apply in the treatment of a malignant lesion in the posterior urethra as in other parts of the body: namely, complete removal or destruction of the growth if at all possible.

The prognosis in the authors' cases seems more favorable for lesions in the anterior than in the posterior urethra. Since at least half the patients with anterior urethral lesions are living 2 years after operation, while half of those with posterior urethral lesions were dead a year after operation, probably the difficulty of complete removal of a growth situated posteriorly may be a factor in this regard. Of the 10 patients who had an epithelioma in the anterior urethra, 3 are known to be dead and 7 are living. Three of these 7 have had a recurrence and none of them is known to have survived for as long as 5 years. The shortest postoperative follow-up in this group of 7 patients was 5 months and the longest 5 years, the average being 21 months.

Of the 14 patients who had lesions in the posterior urethra, 12 are known to be dead; however, 1 of these lived 4 years and another 9 years and at the time of death had no evidence of recurrence. One other of the 14 patients was alive and apparently well at least 5 years after treatment and 1 patient has not been traced. The patient who had a lesion which involved both the anterior and posterior portions of the urethra died 4 months after treatment, which consisted solely of roentgen therapy. Obviously, the results in both groups of cases leave much to be desired. However, the fact that a few patients have survived as long as 5 years affords some encouragement. For the most part treatment in these cases consisted in complete surgical removal or local destruction of the lesion.

GENITAL ORGANS

The Obstructive Prostate. FRANK HINMAN. *J. Am. M. Ass.*, 1947, 135: 136.

The obstructive prostate is of several varieties; benign enlargements and median bar formations are almost always obstructive; inflammations, cysts, prostatic calculi, leiomyomas, and fibromyomas occasionally are obstructive, but cancer is infrequently obstructive unless it is associated with one of the preceding conditions. The present discussion is limited to benign enlargement and carcinoma of the prostate.

The majority of authorities believe that benign enlargement of the prostate is a new growth of fibrous muscular and glandular tissues serving no physiological purpose. It is not invasive but always encapsulated, and with growth it compresses the uninvolved parenchyma of the prostate into the so-called false capsule from which it can be enucleated en-masse. A theory of origin of the growth assumes that the initial lesion is a fibrous nodule which stimulates extremely early and rapid penetration of glandular elements from the periphery. The process begins in the submucosa of the prostatic urethra and vesicle neck as multiple outshoots of young spindle cells which soon develop into small fibromas and fibromyomas which are quickly invaded by the ingrowth of the adjacent glandular tissues to form the pathological picture of fibromyoadenomas, the benign enlargements of the prostate.

Cancer of the prostate also occurs in later life and the two often occur together but are unrelated otherwise. Cancer arises from any part of the parenchyma of the true prostate, usually in the periphery. Only early lesions near the surface of the posterior portion are palpable per rectum. All other lesions, no matter where they start, would extend to involve

the posterior portion and be palpable, but their diagnosis then is late and the late lesion is incurable. Because of the recent advent of endocrine therapy and relief of obstruction in the treatment of cancer of the prostate, the author wishes to determine whether early diagnosis and radical surgical procedures are still applicable in its treatment. In order to better analyze the problem he approaches it from four standpoints: (1) a discussion on what is known about cancer; (2) what happens without any treatment, or with the ineffective methods of radium and x-ray therapy; (3) how effective is endocrine therapy; (4) what has been accomplished by early diagnosis and radical surgical intervention?

1. With the lengthening of life expectancy there has been an increase in the number of deaths from cancer. About seventeen million of the approximately seventy million males in the United States are over 50 years of age. The incidence of cancer of the prostate in this group is variously estimated from 14 to 16 per cent. This means that at least three million to five million, and possibly as many as eight million Americans now have cancer of the prostate. It is almost universally agreed that primary cancer arises in the prostate gland, unrelated to enlargement which arises from the periurethral glands. It seems reasonable to conclude that cancer may start in any portion of this part of the gland. It then spreads within its capsule so that no matter where it started the posterior portion is involved, before invasion of the seminal vesicles; hence the problem of early diagnosis is not only the discovery of the primary lesion by rectal palpation but also the development of methods by which the occult forms of cancer which are not palpable may be discovered. According to Kahler, involvement of the perineural lymphatics is one of the earliest changes in cancer of the prostate. Opponents of radical intervention believe that lymphatic invasion means metastasis and therefore, since neither the primary or secondary lymph zones of the prostate can be removed, an operative procedure is useless even in early diagnosis. They overlook the fact, however, that this early invasion of lymph spaces surrounding the nerve is confined within the true capsule of the prostate for a long time. Extension into the vesicles, invasion of distant lymphatics, bones, and viscera by way of the blood stream are late manifestations. Complete removal and cure of the lesion while it is limited within the prostate is possible, and has been accomplished repeatedly even when perineural lymphatics in the capsule have been invaded.

2. Studies of what happens without treatment are few, but studies which have been carried out indicate that between 90 and 95 of every 100 men will succumb within 5 years of the time cancer strikes them. Inasmuch as the life expectancy at 60 years of age is 17 years, then, of 100 men at 60 years, between 80 and 85 of them will be living 5 years later, but if all at the age of 60 had had prostatic cancer, more than that many would be dead. In other words, from 10 to 15 of 100 men with cancer at the age of 60 will die from other causes, and from 80 to 85 will die from cancer within 5 years. This big difference in mortality rates between a group without cancer, and a group with cancer shows the error in the general attitude of indifference which arises from a belief that these men haven't long to live anyway.

3. None of the experiences with castration and endocrine therapy have as yet covered a 5 year period. Analysis of the reports which have been presented indicate that in a 5 year period almost as many will die as in the untreated series. The real benefit that most patients with advanced cancer of the prostate derive from hormonal therapy must not be minimized. The relief from pain, the improvement of urination with recession of the local growth, and gain in general health are often remarkable. The immediate benefits are not permanent and the cancer may show an increase of virulence later.

4. Of 100 men with cancer of the prostate, only about 5 are seen early enough to justify radical surgical procedures. Series of cases have been reported with 48 per cent and 56 per cent 5 year cures, respectively. Cancer involves the prostatic glands first, arising as a rule near the periphery of that portion involved; it grows slowly in the beginning and there is ample time for early recognition. If it is located in the posterior portion it may be palpable per rectum. If in the lateral, anterolateral, or median portion, it may be suspected and discovered by other methods.

The early lesion in the posterior portion gives the sensation of stony hardness. It feels flat rather than spheric. It is just beneath the capsule, more superficial than deep, and it has a sharp edge or corner. It is perceived best with the patient leaning forward with hands on a chair or elbows on a table, feet apart. Local lesions of inflammation are rounded or nodular and an x-ray picture of the area is always indicated in order to rule out the presence of stone as the cause of the induration. When the observations are characteristic or suggestive enough, the patient should be prepared for the perineal operation, at which the area is exposed, and a biopsy should be taken and examined immediately by frozen section. If positive, radical removal is completed. Associated enlargement can be enucleated, or, if it is small a transurethral section can be done at once through an opening in the urethra before closure of the perineum. Needle biopsies are misleading and have been largely abandoned. Primary lesions which cannot be palpated per rectum may be discovered by microscopic study of material removed at transurethral resection, or of the specimen after perineal or suprapubic enucleation for enlargement. These cancers invade the enlargement at its periphery. They start in the parenchyma of the gland, compressed by the enlargement to form its false capsule. Resectionists should put aside for particular microscopic search the material removed from the deeper peripheral portions of the enlargement.

Many writers believe that enlargement is never a focus of origin for carcinoma of the prostate. Even

this is only partially correct, every suprapubic and perineal prostatectomy should be followed by a careful search of the surface of the specimen, and of the cavity left after enucleation, and a biopsy with frozen section of any areas at all suggestive should be made. A cure by radical removal is then possible.

The evidence now available indicates that discovery of cancer by early diagnosis should be made while it is limited within the capsule of the prostate, that radical surgical intervention at this time will cure over 50 per cent of the patients, and that to increase the number of early diagnoses above the present dismal 5 per cent is a worthy effort.

It is evident also that benign enlargement and carcinoma are distinct and separate lesions of the prostate, even though they commonly occur together. ROBERT O. BEADLES, M.D.

Retropubic Extravesical Prostatectomy. Millin's Operation. Technique and Indications (La prostatectomie rétro-pubienne extra-vésicale. Opération de Millin. Technique et indications.) R. GOUVERNEUR, P. ABOULKER, and A. DUFOUR. *J. chir.*, Par., 1947, 63: 425.

Seventy prostatectomies by Millin's method have been performed by the authors. Two fatalities occurred and in 1 case incontinence developed but healed spontaneously within a year. In 2 patients secondary cystostomies, and in 2 others secondary endoscopic resections, were required. In 12 patients primary and secondary hypogastric fistulas followed the operation, and closed within 20 or 30 days after insertion of a retention catheter. The first operation was performed more than a year prior to the publication of this article and so far no undesirable late sequelae attributable to the intervention have been noticed.

The authors performed the operation on 2 patients who had had cystostomies. A retention catheter was introduced through the urethra after a débridement of the margins of cystostomy. Both patients recovered but the duration of the convalescence was not shorter than that usually observed after Freyer's operation.

Millin's operation offers certain advantages over the perineal prostatectomy: the prostatic gland is approached anteriorly, which avoids injury to the rectum, and also to the verumontanum which may lead to sexual impotence. The danger of injury to the striated sphincter, with the resulting incontinence of urine, is also avoided.

The use of Millin's retractor greatly facilitates the operation. An electric knife and a suction apparatus are indispensable. The authors advocate spinal anesthesia. The patient is placed in a horizontal position with the head slightly lowered. The incision should not extend more than 5 or 6 cm. above the symphysis pubis. Pfannenstiel's incision may also be employed. The success of the operation depends upon good exposure. The capsule is incised in a transverse direction as high as possible, usually about 0.5 cm. below the vesicoprostatic groove. One of the assistants elevates the prostatic gland with two fingers introduced into the rectum. The digital enucleation of the adenoma starts at its lower pole. After a section of the vesicourethral mucosal cuff, the adenoma is removed. The posterior lip of the cervicovesical orifice is resected to prevent a stricture. A catheter is introduced into the bladder through the urethra. A rubber drain and sulfanilamide are placed into the wound which is then closed. The vasa deferentia are closed at the beginning or at the end of the operation.

The following postoperative complications may develop:

1. Displacement of the catheter or its occlusion by blood clots. To avoid this complication, the catheter should be attached to the prepuce with a suture and it should be irrigated at frequent intervals. Sometimes a suprapubic cystostomy may be necessary.

2. Intravesical hemorrhage. If lavage of the bladder does not stop it, cystostomy with or without packing of the cavity resulting from the prostatectomy should be done.

3. Formation of a suprapubic fistula which may develop soon after the operation or after removal of the catheter. The first type is caused by an insufficiency of the suture of the prostatic capsule and is of no great clinical importance. The second type can be cured by insertion of a retention catheter through the urethra. Incision through the capsule should be done with a scalpel, in preference to an electric knife, to avoid a superficial necrosis of the margins of the wound. A good grade of chromic catgut should be used for the sutures. Finally, the administration of plasma or amino acids to correct nutritional deficiencies helps to avoid the formation of a secondary fistula.

4. Retention of the urine can usually be avoided by wedge shaped resection of the posterior lip of the neck.

5. Incontinence of the urine can be prevented by sectioning the urethra with scissors to avoid laceration.

Millin's operation should not be performed in the presence of a urinary infection. The operation is indicated in the presence of an intraprostatic adenoma of medium size. It is very difficult to find a small adenoma and it can be removed more efficiently by endoscopic resection; giant adenomas should be excised through the bladder. The operation is contraindicated in obese individuals for technical reasons.

JOSEPH K. NARAT, M.D.

Misconception of the Gubernaculum Testis. L. J. WELLS and DAVID STATE. *Surgery*, 1947, 22: 502.

Because of the many descriptions in the literature of the gubernaculum testis there has been a great deal of confusion concerning it. The main object of the present study was to determine whether the gubernaculum could be identified in surgical patients. A second and related objective was to search for any discrete band of tissue which might account for the widespread opinion that the gubernaculum

extends below that part of the inguinal bursa which normally becomes the spermatic sac.

Four patients were selected for careful study. During surgery the procedure was: (1) to identify the inguinal bursa, (2) to search for a cord of tissue below its blind end, (3) to open the bursa in order to note any manifestations of a gubernaculum on its posterior aspect, (4) to tag crucial portions of the bursa for the purpose of orientation in microscopic studies, and (5) to remove the bursa plus attached strands of tissue after freeing the testis. The surgical specimen thus obtained was fixed and studied microscopically.

It was found that sections of the gubernaculum could not be identified in any of the microscopic preparations of the 4 surgical specimens. Therefore only 1 of the case reports is presented in detail.

In this case, the patient was a white male 12 years of age with the main complaint of failure of descent of the testis bilaterally. One year previous he had received a series of 16 injections of gonadotropin without benefit. The patient's father and 2 brothers each had unilateral failure of descent of the testis.

Physical examination revealed a well nourished, well developed boy who was not acutely ill. The examination was negative save for a bilateral cryptorchidism and a left inguinal hernia. The left testis could be felt high in the inguinal canal but the right testis could not be palpated at all.

Surgery was done on July 1, 1946 and the following observations were made. The inguinal ring was visible as soon as the skin and subcutaneous tissues had been incised. A structure in the inguinal canal, subsequently identified as the testis, could be moved upward and downward by exerting manual pressure, but it would not pass through the external ring. The first indication of an inguinal bursa to appear was an indistinct outline of its fundus. Below the fundus it was impossible to see or to palpate any cord of tissue which might be said to resemble a gubernaculum.

When the bursa was opened, the testis could be seen through its thin covering of peritoneum. A gloved finger in the peritoneal sac could enter the abdominal cavity by passing through the patent orifice of the bursa. Extending down from the tail of the epididymis was some unknown, retroperitoneal structure that elevated the peritoneum to produce a longitudinal ridge. Aside from its narrowness, this ridge looked somewhat like that caused by a gubernaculum. It was tagged by means of a thread; then this structure, the part of the bursa distal to the testis, and the attached "ligament" were excised as a unit and placed in fixing fluid.

In microscopic studies of transverse sections of the bursa, the 4 layers of its wall were observed. The most distinct ones were the peritoneal and the cremasteric. Since a gubernaculum, like a testis, is a retroperitoneal structure, the internal spermatic layer is the one which should be expected to contain it. Despite most careful search, no trace of a gubernaculum could be found. Transverse sections of the tissue tagged by means of thread showed that the ridge of peritoneum observed during surgery was caused by blood vessels in the subperitoneal layer.

A block of tissue including the fundus of the bursa and the upper part of the attached "ligament" was sectioned serially and vertically. The sections showed that the "ligament" consisted of areolar tissue, fat, and small blood vessels.

In this case, it is clear that the "ligament" created by blunt dissection should not be called gubernaculum testis. On the posterior aspect of the internal spermatic layer of the bursa where a gubernaculum, if present, should be expected to lie, none could be found. These observations, however, should not be taken to mean that a gubernaculum could not be identified in all of the patients with an undescended testis; they are evidence against the common notion that a place to look for one is below the bottom of the bursa.

In conclusion, the authors state that they were unable to identify a gubernaculum in any of 4 selected patients who were subjected to orchiopexy. The notion that it may be found below the fundus of the inguinal bursa in such patients is due to a misconception. If present, it should lie on the posterior aspect of the bursa and in the internal spermatic layer. R. O. BEADLES, M.D.

On Malignant Tumors of the Testicle. SIR GORDON GORDON-TAYLOR and NORMAN R. WYNDHAM. *Brit. J. Surg.*, 1947, 35: 6.

The authors describe their experience with over 700 patients suffering from primary malignant neoplasms of the testicle. Secondary malignancies are rare, only about 50 having been recorded in the literature. Metastatic carcinoma of the epididymis is still more exceptional, only 3 cases having been reported.

The authors distinguish 2 main types, namely, the teratoma and the seminoma which can be easily recognized grossly; these tumors should be confirmed microscopically. Of 688 cases of testicular tumor, 461 (67 per cent) of the tumors were seminomas while 227 were regarded as teratomas; chorioncarcinoma accounted for a little more than 1 per cent of the lesions, while sarcoma was very rare.

Seminoma is a seminal carcinoma and is unrelated histogenetically to teratoma. Willis believes that (1) transitions from seminal tubules to tumor can often be traced, and the appearances cannot be explained by secondary invasion of the tubules; (2) serial sections of seminomas, even small ones, show no teratomatous elements; (3) undifferentiated embryonic epithelial tissue is a frequent component of malignant teratomas; (4) when genuine seminoma and teratoma coexist in one testicle there is often distinct separation of the two neoplasms by testicular tissue or a fibrous capsule.

The "radical operation" is today employed under exceptional circumstances by a few surgeons. Even Himnan has recently performed a radical operation after irradiation in 3 out of 58 cases. Nowadays the

operation of choice is a "simple mundane surgical exercise akin to that performed with consummate skill and dexterity by veterinary surgeons." Simple excision of the malignant testis should be combined with irradiation. This therapeutic combination has improved the prognosis. ROBERT TURELL, M.D.

MISCELLANEOUS

Glandular Metaplastic Malignancy. W. E. KITTREDGE, JOHN C. HENTHORNE, and MARK WHITEHEAD. *J. Urol.*, Balt., 1947, 58: 282.

Tumors in the urinary tract which contain glandular elements are not commonly seen, but when they do occur they present certain practical and theoretical problems as to (1) whether the glandular elements represent metaplasia of transitional epithelium to glandular epithelium, (2) whether the lesion is primary in the urinary tract or metastatic from the intestine or other glandular organs, and (3) whether the tumor arises from known glandular elements at the attachment of the urachus or around the vesical neck.

Transformation of the urinary epithelium from transitional to glandular type is known to occur in exstrophy of the bladder and is said to take place in cystitis cystica. Metaplasia of this type in tumors was described by Stoerck as early in 1899, and in 1907 Stoerck and Zuckerkandl called attention to the similarity between the glandular tissue of tumors of the bladder and the mucosa of the large intestine.

In a recent review of the literature Foot gives an excellent discussion on metaplasia of urinary tract epithelium and reports 3 cases; the metaplasia occurred in the epithelium of the renal pelvis in 1 case and in the epithelium of the bladder in the other 2 cases. In 1 of the latter 2 cases a malignant tumor (adenocarcinoma) was found.

The authors report 4 cases of glandular carcinoma of the urinary tract to illustrate the difficulty of determining whether an adenocarcinoma is primary or secondary in this location. In 1 case the tumor of the bladder was probably metastatic from a carcinoma of the colon. In 2 cases the adenocarcinoma probably arose from plaques of urinary tract epithelium which had undergone metaplasia to the secretory type. In 1 case metaplasia of the epithelium to the secretory type evidently occurred in an infiltrating transitional cell carcinoma.

JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

On the Problem of Trauma and Aseptic Osteonecrosis. IVAN HERMODSSON. *Acta radiol.*, Stockh., 1947, 28: 257.

Aseptic osteonecrosis may be caused by a trauma, or there may be a predisposing factor of some kind. In trauma, the fracture or a vascular disturbance alone may be responsible for the aseptic necrosis, or the fracture and a vascular disturbance may be responsible jointly. The possibility that the predisposing factor may be localized in the bone nucleus or in the vasomotor nerves of the autonomic nervous system is considered. Three case histories are presented in detail.

The first case was an injury to the elbow and resulted in an aseptic necrosis in the capitellum and in the head of the radius. The second case was a fracture of the epiphyseal nucleus of the head of the radius and a fracture of the metaphysis. In this case, Schlatter's disease developed shortly afterward. In the third case, osteochondritis dissecans occurred in the lateral malleolus after trauma to the ankle.

In the cases in which an x-ray examination was made immediately following the injury, a primary fracture was excluded. Thus, it is assumed that the trauma gave rise to a vascular disturbance which subsequently caused necrosis. There was no indication in any of these cases that there are any predisposing factors. RICHARD J. BENNETT, JR., M.D.

Generalized Lipoid Granulomatosis. TORFINN DENSTAD. *Acta radiol.*, Stockh., 1947, 28: 269.

A case report is presented of a man 52 years of age whose condition was diagnosed as congenital syphilis and leg ulcers. At another time, a diagnosis of periostitis and osteomyelitis was made. Multiple operations were performed on several bones of which the microscopic examination showed no indication of tuberculosis or syphilis. Subsequent multiple fistulas occurred in other portions of the body. At the age of 27, he had developed a fracture of the left upper arm. Between the ages of 50 and 52 he was given extensive treatment because of an ulceration of the right leg. In other words, many variable diagnoses were made over a period of years.

The author believes that osteitis fibrosa generalisata must be considered as a diagnosis, and he discusses Albright's disease also. In the x-ray department, it was concluded that this case was probably one of generalized xanthomatosis or, more clearly termed, lipoid granulomatosis which is a form of Hand-Schueller-Christian's disease. The blood cholesterin showed high normal figures. From the high cholesterin figures and study of the clinical course in retrospect, the diagnosis of xanthomatosis was made. RICHARD J. BENNETT, JR., M.D.

Multiple Myeloma: A Survey Based on 35 Cases, 18 of Which Came to Autopsy. LOUIS LICHTENSTEIN and HENRY L. JAFFE. *Arch. Path.*, Chic., 1947, 44: 207.

Multiple myeloma is a clinically and anatomically distinctive malignant disease of the skeleton apparently arising from the myeloid formative tissue. It is somewhat more common in males and in the fifth and sixth decades of life, although it is not uncommon in the thirties. A few unequivocal cases have been reported in adolescents. In some cases the disease may be localized to a focus in one bone only for years. Although the bony framework may be riddled with foci of myeloma, it is only infrequently that gross myelomatous foci are found in the viscera and other extraskeletal parts. In some cases myeloma cells invade the blood stream and may create a leucemic blood picture (so called plasma cell leucemia).

The patient usually presents himself with a complaint of pain, especially of the back and thorax, often vague and generalized and accompanied by a feeling of weakness. The weight loss is usually substantial. Pathological fracture of the spine or long bones is common. With involvement of the lumbar region sciatica was a common symptom. Sometimes a palpable tumor of an exposed bone such as a rib or clavicle is the presenting complaint. The course of the disease varies a great deal: the average period of survival following the onset of symptoms was about 2 years, although 1 patient survived 9 years and another is still alive 10 years after the onset. Long periods of remission are apparently spontaneous and not related to treatment.

The roentgen picture of multiple myeloma varies. In advanced cases many bones, including the calvarium, are riddled by osteolytic defects; in other cases (when myelomatous infiltration of the bone marrow is diffuse) roentgen changes may be minimal. If the infiltration is generalized, marked anemia may result. Sternal bone marrow studies should be made whenever the presence of myeloma is suspected, and especially when biopsy of some obviously affected bone is not feasible. Hypercalcemia (ranging as high as 18 mgm. per cent) is present in about one-half of the cases, reflecting the lytic resorption of the bones. The kidneys in such cases tend to show deposits of calcium granules in the tubular epithelium and interstitial connective tissue, and renal failure may develop. It should be possible to distinguish this condition from hyperparathyroidism since the serum phosphatase activity tends to be normal no matter how extensive the skeletal involvement may be. Hyperglobulinemia (from 3 to 14 gm. per 100 c.c. of blood by the Howe method) is observed in about half of the cases. The serum albumin level is either normal or diminished, apparently because of loss of albumin through the damaged renal tubules. The presence in the urine of protein, giving the Bence-

Jones reaction, is noted in about 50 per cent of the cases. Its excretion may be intermittent. Protein excretion in the urine very rarely occurs in other conditions (senile osteomalacia, gunshot wounds, polycythemia). Amyloidosis is noted in about 10 per cent of the cases and amyloid deposits may be found in great quantity in the skeletal connective tissue generally.

Cytologically, multiple myelomas may be divided roughly into two groups: (1) those in which the tumor cells are quite uniform, predominantly small, and have a superficial resemblance to plasma cells (hence the term "plasma cell myeloma"); and (2) those in which the characteristic cell is considerably larger and more variegated. The authors emphasize the unity of multiple myeloma and explain cytologic variations within them as expressions of their relative maturity or immaturity. The identification of the common ancestral cell of multiple myeloma is still a moot point, but this is probably of myeloid formative or hematic origin. Since multiple myeloma is such a distinctive disease entity, clinically and anatomically, it seems unreasonable to attempt to subclassify it into plasma cell, myeloid, erythroid, and lymphoid myeloma.

Problems in therapy are concerned mainly with relief of the distressing bone pain, general supportive measures, and the care of such complications as pathological fractures and cord compressions. X-ray therapy may relieve the bone pain, although it apparently has little influence on the course of the disease. Radioactive phosphorus sometimes results in subjective improvement, although it probably is not as effective as roentgen therapy and may produce a dangerous leucopenia and thrombocytopenia in some cases.

"Stilbamide" and "pentamidine" in conjunction with a diet low in animal protein have been advocated. But palliation only is claimed for these drugs and they are not without distressing side effects.

Blood transfusions should be given for marked anemia. Laminectomy (followed, but not preceded by, roentgen therapy) may permit recovery of function for a number of years when transverse myelitis results from extradural compression.

VERNON C. TURNER, M.D.

Benign Central Cartilaginous Tumors of Bone. BRADLEY L. COLEY and ANTHONY J. SANTORO. *Surgery*, 1947, 22: 411.

In a study of the records of 22 central chondromas the authors concluded that there may be a long latent period during which the presence of the lesion is not suspected. Usually the tumor is noticed between the ages of 10 and 30 years. It appears more commonly in the long bones. Both sexes are equally affected. About one-third of the cases present involvement of the phalanges. This lesion is the most frequent tumor found in that location.

A simple chondroma may be completely symptomless. When it has altered the contour of the bone the patient may notice swelling or deformity. Pain, when present, is generally inconstant and mild. Disability is infrequent. Pathologic fracture, especially in phalangeal chondromas, is often the incident which precipitates recognition of the condition. The trauma which results in the fracture is often trivial and nearly always less severe than that which is responsible for simple fractures through normal bone.

Grossly, the tumor lacks the appearance of tissue seen in simple cysts, giant cell tumor, or fibrous dysplasia. It presents a solid, whitish, firm mass completely filling the cavity and has a slightly gritty feel when attempts are made to remove it with the curette. At times calcific particles are seen and felt, but the purely fibrous quality of fibrous dysplasia, the vascular reddish nature of giant cell tumor, and the fluid filled spaces of simple cyst are lacking. Myxomatous changes are not uncommon, and it is probable that the extremely rare cases of pure myxoma of bone which have been reported are examples of degeneration of a central chondroma. While not encapsulated, the lesion is usually rather definitely circumscribed and for this reason it is possible to remove it completely by painstaking curettage. The cells are usually rounded but may vary in size and may become fusiform or stellate. Calcification may be seen in scattered areas.

In the x-ray film it is often possible to confuse the picture with that presented by bone cyst, giant cell tumor, and nonosteogenic fibroma of bone. The treatment of central chondroma is surgical. For lesions in the rib, fibula, and scapula, resection of the entire tumor-bearing area is indicated. When the involved area constitutes a considerable proportion of the thickness of the shaft of an essential long bone (femur, humerus, tibia) it is important to utilize bone chips from the ilium or pencil grafts from the tibial cortex to fill the defect and to assure more complete and more rapid bone regeneration.

In this series of 22 patients there were only 2 recurrences of the tumor. Both of these were successfully managed by reoperation. Roentgen therapy is not satisfactory.

The authors state that the benign chondroblastoma is not a giant cell tumor and that it belongs properly with the tumors of cartilaginous origin. Jaffe and Lichtenstein considered it to be distinct from giant cell tumor and not even a variant of it. They termed it a benign chondroblastoma. This lesion is not confined to the upper humerus as is noted in Codman's original description of the tumor. Roentgen therapy may be successful in chondroblastoma in contrast to its effect on central chondroma. Chondroblastoma more closely resembles giant cell tumor than does central chondroma. At times chondroblastoma presents roentgen evidence suggestive of a malignant bone sarcoma. Pain and swelling at the site of the lesion is the usual complaint. Trauma has not been shown to be of etiologic importance, although an injury to the part might well attract the patient's attention to it.

C. FRED GOERINGER, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Diagnosis and Treatment of Recurrent Dislocation of the Shoulder. Ross Robertson and W. J. Stark. *J. Bone Surg.*, 1947, 29: 797.

Twelve patients with anterior dislocation and 3 with posterior dislocation of the shoulder were treated by open operation. All of the injuries were traumatic in origin and there had been multiple recurrences. These operations were performed from 7 to 18 months previous to the publishing of this article. Thirteen of the 15 patients have returned to work, and most of the patients do hard labor. There has been an average of from 10 to 15 degrees of limitation of external rotation and abduction in the anterior dislocations, and a similar limitation of internal rotation and abduction in the posterior dislocations.

The author suggests that through a posterior lateral incision, the acromion be divided and rotated outward to give free access to the joint. The operation consists mainly in locating the lateral edges of the ruptured capsule and suturing it securely to the edge of the glenoid. The structures are then anatomically put back into normal relationship.

Richard J. Bennett, Jr., M.D.

Metacarpal Reconstruction. J. William Littler. *J. Bone Surg.*, 1947, 29: 723.

The main reason for metacarpal reconstruction is the restoration of function. The success of the operation is in direct proportion to the accuracy with which the graft is fitted to the carpal, metacarpal, or phalangeal fragments. If only the head of the metacarpal remains, it can be stabilized by extending the graft into the carpus. If only the base remains and the finger is preserved, the graft can be fused to the proximal phalanx at 30 degrees of flexion.

When there are multiple metacarpal defects, multiple bone grafts may be placed in one operation. If the proximal portion of the first metacarpal has been destroyed, the distal fragment may be fused to the carpus if the thumb is placed and maintained in a functional position. If an injury should involve the distal portion of the first metacarpal with extension into the metacarpophalangeal joint, a fusion of this joint at approximately 30 degrees of flexion is recommended. At the time of operation, all the scar tissue is resected. The proximal fragment is recessed with an osteotome at an angle of approximately 30 degrees. The distal fragment is cut transversally and the medullary cavity is opened to receive the doweled end of the graft. The defect is carefully rebuilt with a graft measuring at least ½ inch longer than the estimated defect. The dowel is formed at one end of the graft and the other end is cut obliquely at 30 degrees. Tissues are carefully closed over the graft. The various steps of the operative procedure are illustrated in the original article. Following the operation, a plaster-of-Paris cast is applied. A period of 2 months is required for good union. Forty-four patients, with a total of 56 individual grafts, have been operated upon. Two small grafts were absorbed and 1 graft failed to unite.

Richard J. Bennett, Jr., M.D.

Ambulatory Treatment of Hallux Valgus. Edward L. Compere and William J. Schnute. *Surgery*, 1947, 22: 545.

A total of 24 patients were subjected to one or more operations for hallux valgus in the operating room of the outpatient clinic and then permitted to go home immediately by whatever transportation they could obtain. There were no complications. The results which were obtained were definitely better than those which had been observed in patients whose care had included 2 or 3 weeks of hospitalization with complete immobilization. These patients suffered minimal pain and all of them returned to the clinic walking surprisingly well and with an excellent range of motion in the metatarsal phalangeal joint. Local novocaine anesthesia was used.

In another series of 17 patients who where hospitalized for hallux valgus and bunions an additional 26 operations were performed. The patients who were operated upon under local anesthesia were encouraged to walk about their rooms immediately after the operation and were given bathroom privileges. Because of persisting anesthesia, they experienced no pain. In summary, the author states:

1. The hallux should be splinted by means of corrective bandaging, without rigid fixation, following the operation. Multiple layers of bandage are essential if correction of the hallux valgus is to be maintained while ambulation is permitted.
2. Walking with full weight bearing is begun immediately when the operation is done under a local anesthetic, and on the day following the operation when it is carried out under general anesthesia.
3. The patient may be discharged from the hospital from 2 to 4 days after operation.
4. The original dressing should be changed and the sutures removed 14 days after operation.
5. The functional splinting by corrective bandaging should be continued for an additional 2 weeks.
6. Patients may be encouraged to resume their normal activities at the time that the bandaging is discontinued.
7. After bandage splinting is discontinued, the foot should be soaked in warm, slightly soapy water for 20 minutes each day. While in the warm water the toe should be actively exercised.
8. Low heel, soft leather oxford shoes with a stiff shank, straight inside last, and metatarsal pads should be worn for at least 3 months.

C. Fred Goeringer, M.D.

Pseudarthrosis Resulting from the Use of the Intramedullary Nail of Kuentscher (Primi tentativi di terapia delle pseudartrosi col chiodo endomidollare di Küntscher). Pasquale Del Torto. *Gior. ital. chir.* 1947, 3: 373.

The author presents a review of the history of internal fixation of fractures from 1826 to the advent

of the Kuentscher nail in 1940. He discusses the theoretical and practical advantages of the use of the intermedullary nail of Kuentscher. He also presents some of the disadvantages of this method in 4 case reports in which nonunion resulted. Three of these cases involved the femur and 1 case the humerus. These cases were reported as a warning against the optimistic trend of thought of some European and American surgeons in regard to this method.

CARLO SCUDERI, M.D.

FRACTURES AND DISLOCATIONS

The Olecranon Process. FRANCIS M. MCKEEVER and RONALD M. BUCK. *J. Am. M. Ass.*, 1947, 135: 1.

The removal of the fractured fragments of the olecranon process of the ulna is recommended when there is comminution of the fragments. This does away with the long healing process with considerable extra bone formation, and usually involves some limitation of motion.

Total excision of the fractured fragments was carried out in 10 patients. In 7 patients, there were old ununited fractures. The average restriction of flexion in the elbow in these 7 patients was 38 degrees. The average loss of extension of these same patients was 28 degrees. All of the patients experienced less pain after the operation and all of them had an increase in the range of motion of the elbow. The average improvement in motion was 57 degrees. Three patients believed that they traumatized their ulnar nerve more easily than before the excision of the olecranon. Stability of the elbow joint is dependent on the coronoid process and the distal vertical face of the ulna. If the fracture of the ulna is distal to the coronoid process, the fragment should not be excised.

The operation consists of a 20 cm. curved incision over the olecranon. A wide dissection of the tissues is carried out, the ulnar nerve is rerouted, a transverse incision is made through the periosteum of the ulna distal to the site of the fracture, and a flap is turned onto the triceps. The fractured fragments are excised from this flap. The sharp edges of the fractured bone are rounded, the forearm is put into extension, and the flap of the periosteum is drawn tight and sutured to the tissues of the forearm. A molded plaster splint is applied with the arm in moderate flexion for 3 weeks.

All patients were greatly benefited, both subjectively and objectively. None had any instability of the elbow. RICHARD J. BENNETT, JR., M.D.

An Operation for Old Unreduced Bennett's Fracture. JOHN R. VASKO. *J. Bone Surg.*, 1947, 29: 753.

Three cases of old unreduced Bennett's fracture were treated by the suggested method. The greatest improvement following this procedure has been in the grip of the hand. In other cases in which the fracture was not reduced, the grip has been materially weakened.

The operation is performed by making an incision over the dorsum of the base of the first metacarpal, the incision being carried down to the bone, and the opponens pollicis and flexor pollicis brevis are then stripped off. Another small incision is made into the capsule. The small fractured fragment is located, and two small drill holes are placed through the fragment. A third drill hole is made in the base of the metacarpal. The normal relationship is restored and the fragments are held in place by means of passing a No. 24 cotton suture through these holes. After closure a gauntlet type of cast is applied. The cast is left on for 4 weeks, after which active motion is encouraged. The results are reported to be good.

RICHARD J. BENNETT, JR., M.D.

ORTHOPEDICS IN GENERAL

Management of Hand Injuries. F. H. MCC. CALLOW. *Med. J. Australia*, 1947, 2: 349.

Several factors contribute to unsatisfactory management of hand injuries: little attention is given to teaching the subject in classroom lectures and in textbooks; the injuries are often regarded as trivial, although from a functional viewpoint, fractures of the fingers may result in more disability than a fracture of the femur. A hand injury is a surgical emergency.

Examination of the injured hand calls for time and care. Every piece of skin should be saved if possible. The most common cause of crippling of the hand is scarring, which always results when wounds "granulate in." One should test for injury to the various individual nerves and tendons in every case.

Thorough cleansing of the hand and wound in the operating room under general anesthesia is of the greatest importance. After débridement of the wound and careful suture of severed nerves or tendons the wound must be closed if possible. If the skin edges cannot be drawn together the author recommends the use of a Thiersch graft immediately. Covering the wound in this manner promotes rapid healing and prevents infection, and the percentage of "takes" is high. In suturing the wound it is better to use too many rather than too few sutures. Fine needles and fine nonabsorbable suture material (silk, cotton, wire) are essentials. Skin hooks are preferable to forceps in handling the skin. Splinting is usually maintained for 3 or 4 weeks, but should immobilize as few joints as possible; nonsplinted joints must be used.

Rehabilitation of the injured hand is best accomplished by normal use, instituted as early as possible.

VERNON C. TURNER, M.D.

Management of Hand Injuries, Especially the Treatment of Injuries to Bones and Joints. LESLIE J. WOODLAND. *Med. J. Australia*, 1947, 2: 351.

Mangled fingers and hands result in more permanent deformities and in far greater economic loss to the patient than major fractures of the long bones. Of all industrial accidents, injuries to the wrist,

hand, and fingers account for one-third of the number and about one-fifth of the cost. Of 50,000 injuries resulting in permanent partial disability, 45 per cent involved the hand. Twenty-seven per cent of the hand injuries in industry cause some permanent disability. Roughly, 1 in 4 of all hand and finger injuries become infected—a frequency 4 times greater than that found in injuries of other parts. Finger fractures cost about as much in compensation as do fractures which involve the long bones.

Solving the problem of hand injuries is like working a puzzle. If one factor is not correct, the puzzle is unsolved. In hand injuries, and particularly finger injuries, if one tissue—be it skin, tendon, ligament, bone, or joint—is not restored, the result is partial or complete failure to prevent permanent disability.

Fractures of the bones of the hand usually heal in about 3 weeks, and the author believes that if fixation is removed earlier the position is apt to be lost and disability will result. Nonunion is very rare. Decalcification may result from reflex hyperemia due to pain or from infection. Fractures must be accurately reduced since the mechanism of the hand is intimately and compactly fitted together. Fingers splinted in extension will stiffen and full flexion of the other fingers will be impossible. Edema from whatever cause must be very actively treated, for fibrin will be deposited between all the tissues and produce fibrosis. Disuse of the hand alone may cause edema. One must be a fanatic in the crusade against edema in order to secure good results. Occupational therapy of the remedial type is of greater help in rehabilitating the patient than routine physical therapy; passive exercise should not be used in any of these cases.

If it is necessary to use traction (preferably through the pulp of the finger) it must be observed daily to see that it remains effective.

VERNON C. TURNER, M.D.

Correction of Retractions of Extremities by Slow, Bloodless Procedure (Corrección de las retracciones de los miembros por procedimientos lentos— no cruentos). JOSÉ M. JORGE and JOSÉ A. H. BÚLFARO. *Bol. Acad. argent., cir.*, 1947, 31: 586.

Deformities of the extremities attributable to retraction of certain muscles, usually the flexors, and those caused by burns, paralysis of various origins (such as infantile paralysis), congenital myelopathies, and contractures which are sequelae of rheumatic polyarthritis may be of such severity that an operation is impossible or dangerous. In such cases a slow, bloodless correction is recommended by the authors. Uninterrupted or intermittent traction may be applied. The authors usually employ skeletal traction, being careful to use as little force as possible in order to avoid undesirable reactions.

Excellent results have been obtained in 3 patients. In the first, a young man of 19 years, a deformity of both hands and of the left lower extremity had been caused by a burn. The deformity involved both lower extremities in the second patient, a girl of 17 years, and was caused by infantile paralysis. In the third patient, a boy of 11 years, incomplete quadriplegia, either of a congenital character or due to a myelopathy was present. In the last 2 cases the application of casts and conservative surgery in the form of tenotomies and osteotomies were supplemented by gentle traction. In this manner a rehabilitation of the patients was obtained.

JOSEPH K. NARAT, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

The Action of Heparin on Experimental Venous Thrombosis. LEO LEOWE, EDWARD HIRSCH, DAVID M. GRAYZEL, and FLORENCE KASHDAN. *Surgery*, 1947, 22: 746.

The authors, because of the variation of opinion as to the effect of heparin on preformed clots, elaborate upon the in vivo action of heparin on such clots. Heparin in vitro fails to exert any action on clots; heparin in vivo has, on occasion, resulted in disappearance of the clots. The recapitulation of previously recorded experiments was as follows: (1) if heparin was given previous to trauma and continued for a variable period afterward, thromboses were infrequently observed; (2) heparin administered up to 3 days after trauma caused disappearance of the clot in a considerable percentage of cases; (3) heparin administered when the clot was organized resulted in no demonstrable dissolution of the clot.

With the use of rabbits, the authors induced thrombosis in the jugular veins by mechanical means. After a variable control period one vein was removed from the rabbit for microscopic examination, and then heparinization with a heparin-Pitkin menstruum preparation was carried out for 6 to 14 days. The second jugular vein was then removed for study.

From this series of experiments the following conclusions have been drawn: (1) patency can be re-established in a number of experimental veins even as long as 6 days after a clinically visible and microscopically acceptable thrombus is present; (2) the extent and apparently the speed of recanalization is enhanced by the use of heparin; (3) when the vein is so occluded grossly as to preclude the resumption of clinical patency, recanalization is still greater in degree and extent under heparin therapy; (4) in the presence of occluded veins which cause definite obstruction to circulation, the opening of adjacent collateral venous channels is so extensive in the presence of heparin that the combined cross sectional area of the collateral system appears as great, if not greater, than that of the original vein.

EDWARD H. CAMP, M.D.

Post-Thrombotic Sequelae of the Lower Extremity. Treatment by Superficial Femoral Vein Interruption and Stripping of the Saphenous Veins (A Preliminary Report). ROBERT R. LINTON and IRAD B. HARDY, JR. *Surg. Clin. N. America*, 1947, 27: 1171.

The authors report a series of 34 cases of ulcer and edema of the lower extremity, due to incompetence of the valves of the communicating and deep veins, which they treated by interruption of the long saphenous vein and stripping, combined with interruption of the femoral vein distal to the junction of the profunda femoris vein. In every case the valvular incompetence and circulatory defect was due to thrombophlebitis with recanalization, a definite history of thrombophlebitis being elicited in all but 3 cases. The Trendelenberg test, performed with the tourniquet below the knee, revealed incompetent deep and communicating veins in all cases.

The authors describe the procedure and emphasize the necessity of determining venous pressures in the superficial femoral vein distal to a temporarily applied occluding ligature. Measurements are taken with the vein patent, with the vein occluded, and then with the long saphenous vein occluded; should the venous pressure exceed 30 cm. of water with both veins occluded, the operative occlusion of the femoral vein and ligation and stripping of the saphenous vein simultaneously are contraindicated. The authors believe that it is better in such a case to perform only one step of the procedure and to complete it at a later date when the venous pressure has fallen to more normal levels. Emphasis is also placed on the necessity of stripping the saphenous vein from its femoral junction to below the internal malleolus.

The results obtained were encouraging, with failure of ulcer recurrence in all but 1 case, and improvement of edema in the majority of cases, as determined in a follow-up of from 2 to 14 months.

EDWARD H. CAMP, M.D.

The Therapy and Prophylaxis of Venous Thrombosis and Pulmonary Embolism. GORDON A. DONALDSON. *Surg. Clin. N. America*, 1947, 27: 1037.

The therapy and prophylaxis of venous thrombosis and pulmonary embolism in the Massachusetts General Hospital, Boston, is producing results, as evidenced by an incidence of 3 fatal pulmonary emboli for every 1,000 operations there in 1945 as compared with slightly less than one per 1,000 operations in 1946.

Rational treatment of established thromboembolic disease may take one or more of three forms: the use of anticoagulant drugs, lumbar sympathetic block, or deep vein interruption. The use of heparin and dicumarol is based primarily on the prevention of the extension of thrombosis until such time as the established coagulum becomes more strongly organized to itself and to the vessel wall, and until the patient is adequately ambulatory to insure a vigorous venous return. Lumbar sympathetic block rapidly and effectively increases venous return by interrupting reflex arterial spasm resulting from the irritating venous inflammatory process. Deep-vein interruption performed above the level of the thrombosis precludes the further propagation of the thrombus and fatal embolism. Statistics of femoral vein interruption at the Massachusetts General Hospital are presented.

A controlled study in the prophylaxis of postoperative thrombophlebitis and pulmonary em-

bolism was carried out on comparable surgical services in the Massachusetts General Hospital during 1945-1946, the middle-aged patients in the study group receiving dicumarol routinely; in the older aged group, prophylactic superficial femoral vein interruption was carried out. The control group received no dicumarol and vein interruption was done in only a few instances in which patients developed recognizable thromboembolic disease. No fatal emboli occurred in the study group of 2,932 patients, while 6 fatal emboli occurred in the control group of 2,896 patients. The technique of the surgical procedure is outlined. EDWARD H. CAMP, M.D.

Traumatic Arter Vasospasm. PHILIP S. FOISIE. *N. England J. M.*, 1947, 237: 295.

This article is concerned not with the cases of subtotal ischemia in which immediate viability of a part is threatened, but rather with the larger group of traumatic cases wherein the persistence of low grade arterial spasm is likely to cause nutritional changes adversely affecting the functional result. The author contends that in many of these cases of low grade spasm, poor results can be avoided with rational specific therapy.

The incidence of arterial spasm does not parallel the severity of the original wound. Spasm is found more often with the smaller, quickly closed wounds, which suggests that tension is a factor. Injury to large arteries or nerves is not necessarily a part of the mechanism producing arterial spasm. A certain individual susceptibility is thought to be present. Diffuse tissue damage due to the concussive effect of explosive missiles is often a causative factor. The clinical picture includes local discomfort and resistance to function. The patient shows decreased surface temperature, blotchy cyanosis, and diminished peripheral pulses.

A persisting, low grade ischemia causes trophic changes that materially impair the functional result. Two cases of traumatic arterial vasospasm in which sympathetic block resulted in clinical improvement are presented. W. FOSTER MONTGOMERY, M.D.

Surgical Cure of Innominate Aneurysm. HARRIS B. SHUMACKER, JR. *Surgery*, 1947, 22: 729.

Because of the few reported cases of surgical cure of innominate aneurysm, and because it presents such a difficult therapeutic problem, the author presents a report of the surgical cure of an aneurysm of the innominate artery in a soldier.

A summary is made of the 38 reported cases of attempted surgical treatment of innominate aneurysms, and essential points of analysis of these cases are selected as follows: (1) adequate exposure is essential; (2) hemorrhage at the time of operation or secondarily is the greatest attendant risk and commonest cause of death; (3) cerebral difficulties can be reduced to a minimum by repeated preoperative carotid compression; (4) the best surgical procedure from the standpoint of safety to the patient and likelihood of cure of the lesion is proximal and distal ligation combined, when feasible, with excision of the sac or evacuation of its thrombus; division and transfixion of the arteries rather than ligation in continuity is the procedure of choice; (5) for those cases involving the origin of the innominate artery, wiring and coagulation, possibly combined with distal ligation, is probably the safest procedure offering the likelihood of a satisfactory result; (6) preoperative measures to increase collateral circulation are advisable. EDWARD H. CAMP, M.D.

The Clinical Behavior of Arteriosclerotic Aneurysm of the Abdominal Aorta: A Rational Surgical Therapy. ARTHUR H. BLAKEMORE. *Ann. Surg.*, 1947, 126: 195.

In a series of 32 cases of aneurysm of the abdominal aorta, reported from the Presbyterian Hospital, New York, the condition in 26 cases was due to arteriosclerosis, and in 6 cases, to syphilis. Vertebral erosion was noted in 4 of the patients with syphilis and in only 1 of the patients with arteriosclerosis. Aside from the fusiform nature of the arteriosclerotic aneurysms, a second factor was thought to be largely responsible for the rarity of the erosion, namely, elongation of the abdominal aorta. Angulation, with a buckling rather than a bending effect on the vessel, was noted in many specimens studied. This flexion angulation, the author thinks, may play a part in the development of the abdominal aneurysm. Because of the vertebral erosion and the pathology involved, the syphilitic patients showed a higher incidence and severity of pain. Attention is called to the low incidence of pain and erosion with the sclerotic aneurysms. The appearance of deep-seated abdominal pain, low back pain, and pain radiating to the hips or legs, is a warning of impending disaster. Life-saving measures may be instituted even after signs of retroperitoneal hemorrhage.

The ideal surgical therapy for aneurysm entails cure with maintenance of blood flow through the affected vessel. This is accomplished by the electrothermic method herein described. Attempts to introduce a wire and induce clotting date from that of Moore in 1864. The author explains that the circulating blood exerts a pressure on the expanding aneurysm wall which varies with the square root of the surface area and the rate of blood flow. Clotting in turn offers the advantage of physical laws governing solids, and usually clotting within the sac reduces the surface area to only that of a small area of the mouth of the sac. The rate of blood flow through the sac varies proportionately to the size of the mouth. The method of wiring and electrothermic coagulation is described in detail, and the method of determining and utilizing the rate of blood flow in the sac is explained. A technique, with wiring, is described for cure of fusiform aneurysm of the abdominal aorta, and coagulation in conjunction with gradual endoarterial occlusion is described and discussed. Because of the factors tending to increase the incidence of aneurysm, this therapy is assuming more importance. W. FOSTER MONTGOMERY, M.D.

Sympathectomy as an Adjuvant in the Operative Treatment of Aneurysms and Arteriovenous Fistulas. Sympathectomy Performed before or at the Time of Operation. HARRIS B. SHUMACKER, JR. *Surgery*, 1947, 22: 571.

An experience with 303 cases of aneurysms and arteriovenous fistulas is reported. In the present series 290 patients were operated upon, and 13 required no operative treatment because of cure of the lesions by thrombosis. Seventy-eight sympathectomies were done before or at the time of operation. One additional sympathectomy is included, in which the patient was thought to have an aneurysm, but proved to have costoclavicular compression of the subclavian vessels simulating the signs of aneurysm. Of these 79 sympathectomies, 24 were dorsal and 55 lumbar. No deaths and no serious complications occurred. Lumbar sympathetic ganglionectomies were performed under spinal anesthesia through an anterior extraperitoneal muscle-splitting incision. The upper extremities were denervated by the preganglionic operation of Smithwick, performed under intratracheal gas-oxygen-ether anesthesia.

The majority of sympathectomies were carried out in patients with lesions of the larger peripheral arterial stems. Sympathectomy was performed in 25 of 57 cases of popliteal involvement (44 per cent), in 11 of 25 cases of axillary lesions (44 per cent), in 17 of 53 cases of femoral aneurysm or fistula (32.1 per cent), in 3 of 11 cases of subclavian (27.3 per cent), and in 5 of 33 cases of brachial lesions (15.1 per cent). A few sympathectomies were done in instances of involvement of the innominate or common femoral arteries. In 12 of 107 patients with involvement of vessels other than those mentioned, sympathectomy was performed (11.2 per cent). Altogether, 76 sympathectomies were performed in 290 cases in which operative treatment of the aneurysm or fistula was necessary (26.2 per cent).

Sympathectomy was done in a larger percentage of arterial aneurysms (34.5 per cent) than of arteriovenous fistulas (22.6 per cent). This was particularly true in lesions of the axillary, femoral, and popliteal vessels. Although this difference is primarily a reflection of the tendency to poorer collateral circulation in instances of arterial aneurysm, it is partly dependent upon the fact that associated nerve injuries requiring operative treatment were twice as common in cases of arterial aneurysms as in those of arteriovenous fistula. Forty-eight per cent of the arterial aneurysms operated upon involved the subclavian, axillary, femoral, and popliteal arteries; in 53 per cent of the arteriovenous fistulas there was involvement of these vessels.

Sympathectomy was done on 39 patients because of poor collateral circulation, determined principally by the reactive hyperemia test of Matas. In a number of these patients, in addition to evidence of poor collateral circulation, there were other reasons why it was deemed advisable to make every effort to render the collateral circulation adequate rapidly. These were associated peripheral nerve lesions requiring operative treatment (41 per cent), severe pain, pronounced vasospasm, superficial gangrene, and rupture of aneurysm. There were 25 patients in whom the previously poor results of testing collateral circulation became satisfactory after sympathectomy.

In most instances the operation upon the vascular lesions closely followed the sympathectomy. In all but 2 cases, cure of the aneurysm or fistula entailed ligation of the affected artery. In the exceptions, continuity of the artery was preserved or re-established by ligation of the fistula or by vein graft to bridge the arterial defect.

One case of a popliteal arteriovenous fistula is cited, and excision of the fistula was first done 3 weeks after the sympathectomy. Gangrene resulted, which required amputation of the distal third of the foot. There were 14 cases in which sympathectomy failed to render the tests for collateral circulation satisfactory; however, there was considerable improvement. In 1 patient a satisfactory cure by thrombosis occurred, making operation unnecessary, and in 9 patients the continuity of the affected artery was maintained or restored by ligation of the fistula, end-to-end suture, or by vein transplant. In only 4 cases was it necessary to ligate the involved artery. In all cases an excellent result was obtained. In those cases in which the continuity of blood flow through the affected artery was successfully maintained there was, in addition, no fatigue on exercise unless such fatigue had been present before operation. In all cases the color and warmth of the affected hand or foot was observed during a prolonged period of precise occlusion of the artery with a rubber-shod clamp at the time of operation, and in all but 1 case this period of observation showed that the collateral circulation was actually adequate. In many of the cases some anatomic condition was found at the time of exploration which explained adequately the reason for the false results of the tests carried out before operation.

In 10 patients sympathectomy was done because of the impossibility of testing the collateral circulation preoperatively, due to inaccessibility of the vessel. The aneurysms were arterial in 6 cases and arteriovenous in 4. The author believes that the procedure was definitely helpful; in some cases it undoubtedly prevented cold sensitivity postoperatively.

In 6 patients sympathectomy was done because of vasospasm. This was believed to be definitely beneficial.

In 7 patients sympathectomy was done because of causalgia, ischemic lesions, and other conditions. In 2, the procedure was carried out chiefly because of causalgia. Both were improved.

In 7 cases sympathectomy was done needlessly because of error in localizing the lesion. However, the results are listed as excellent, and the mistake appears to have been in localization of the lesions. It is pointed out the arteriography could have been very helpful.

Sympathectomy was performed at the time of operation upon the aneurysm or fistula in 9 patients

for various reasons, and was beneficial in all but 2 cases. In these there was evidence of ischemic paralysis postoperatively, from which recovery was complete in one of the cases.

Consideration is given to the influence of sympathectomy upon the two commonest functional disorders which follow the ligation of arteries for the cure of aneurysms and fistulas, namely, decrease in exercise tolerance and sensitivity of the limb to cold. A careful review of the exercise tolerance in patients having lower extremity lesions showed it to be the same regardless of whether sympathectomy had been performed. Sensitivity to cold of varying degree followed operation upon the subclavian, axillary, and brachial arteries in which ligation was necessary, or in which reparative procedures failed to maintain continuity of the vessel, in 5 of 18 patients in whom sympathectomy was performed before or at the time of operation, and in only 1 of 32 cases of popliteal, femoral, or common femoral lesions treated similarly. Of these 6 patients, cold sensitivity was present before operation in 2. On the other hand, cold sensitivity was present after operation in 13 of 42 patients treated for lesions of the subclavian, axillary, and brachial vessels without sympathectomy, and in 5 of the 65 patients with popliteal, femoral, or common femoral lesions. Eight of these 18 patients had some cold sensitivity before operation. Among those patients operated upon elsewhere, sensitivity to cold was present in 5 of 11 patients with aneurysms or fistulas of the main arteries to the upper extremity, and in 9 of 30 with lesions of the main arteries to the lower extremity. Altogether, 13.7 per cent of those 51 patients sympathectomized before operation upon the vascular lesions had sensitivity of the limb to cold.

Not infrequently sympathectomy was followed by a noticeable increase in the mural thrombus within the aneurysmal sac. Spontaneous cure occurs occasionally without sympathectomy in cases of both arterial aneurysm and arteriovenous fistula. This occurred in 11 of 225 cases studied. On the other hand "cure" by thrombosis occurred in only 2 of 78 patients sympathectomized, an incidence of 2.6 per cent. Thus it is difficult to be certain that the thrombosis is actually the result of the sympathectomy. The hypothesis offered by Gage, that the responsible mechanism is the decrease in peripheral resistance, appears the most explanatory. In 1 case there appeared to be distal extension of the clot in a patient with an arteriosclerotic aneurysm of the popliteal artery. LEROY J. KLEINSASSER, M.D.

Sympathectomy as an Adjuvant in the Operative Treatment of Aneurysms and Arteriovenous Fistulas. Sympathectomy Performed after Operation. HARRIS B. SHUMACKER, JR., *Surgery*, 1947, 22: 597.

The clinical material consists of 290 patients who were operated upon for aneurysms and fistulas, 13 patients in whom a satisfactory "cure" by thrombosis occurred, and an additional 63 patients who had been operated upon by others. Sympathectomy was done before or at the time of operation upon 76 of the 290 patients, and upon 1 of the 63 patients who had been operated upon by others; and it was carried out in 2 of the 13 patients in whom a "cure" by thrombosis subsequently occurred. Sympathectomy was performed after operation in 19 of the first group and in 18 of the second. Sympathectomy was also done subsequently in one patient who had had a "spontaneous cure."

The chief indications for operation in 39 cases were as follows:

1. Sensitivity of the limb to cold. There were 17 patients in this category; 9 had arterial aneurysms and 8 had arteriovenous fistulas. All the patients had annoying coldness of the affected hand or foot upon exposure to cold and most of them had cyanosis. All had discomfort during such exposure and the majority had some degree of numbness of the fingers or toes, and nearly all complained of stiffness of the fingers or toes. Increased resistance to cold was tested with sympathetic procaine anesthesia. Eight patients had associated peripheral nerve lesions. All but 2 patients obtained complete relief from cold sensitivity, and definite improvement occurred in these.

2. Associated paralysis and impaired circulation. In 5 patients sympathectomy was performed in an attempt to improve impaired circulation, in order to afford maximal opportunity for repair of extensively damaged peripheral nerves. Improvement occurred in all cases. It was notable that in those cases in which it was thought the pressure of the aneurysm was partially responsible for the pain there was little improvement by merely operating upon the aneurysm.

3. Persistent edema. Six patients were operated upon for this reason. All had failed to improve under conservative measures and sympathetic block gave only temporary, or no relief. In all there was improvement.

4. Ischemic lesions, causalgia, and other conditions. There were 11 patients in this group and in all the treatment by sympathectomy was beneficial.

LEROY J. KLEINSASSER, M.D.

BLOOD; TRANSFUSION

Hemophilia: A Report of the Mechanism of the Development and Action of an Anticoagulant in 2 Cases. CHARLES G. CRADDOCK, JR., and JOHN S. LAWRENCE. *Blood*, 1947, 2: 505.

Two cases of hemophilia are presented in which the development of a circulating anticoagulant was detected. This anticoagulant was demonstrated in the whole blood, plasma, and serum in both cases. One of these cases has been previously reported by Lawrence and Johnson and a similar one was reported by Munro and Jones in 1943. Munro and Jones suggested that numerous transfusions are responsible for the development of this anticoagulant. Munro later showed by plasma fractionation that the anti-

coagulant activity was associated with the globulin fraction of the plasma; this is the gamma globulin fraction. Lawrenc eand Johnson found it to be heat stabile and nondialyzable through collodion.

Both of the authors' patients became refractory to treatment with either fresh whole blood, plasma, or antihemophilic globulin (Fraction 1 of Cohn). In fact, the anticoagulant apparently made its appearance as a result of repeated transfusions or injections of antihemophilic globulin. The authors showed that antithromboplastin was not present in enough strength to explain the anticoagulant activity of the patient's blood. The anticoagulant in each case was shown not to inhibit any of the elements participating in the classical theory of clotting, i.e., prothrombin, thromboplastin, thrombin, or fibrinogen. It was also demonstrated that this anticoagulant was not related to heparin in its mechanism of action.

Electrophoretic fractionation of the plasma was carried out, and it was found that the anticoagulant was associated with the gamma globulin fraction of plasma. The demonstration of specific precipitin titers in the serum of each of these patients against antihemophilic globulin seemed to indicate that the mechanism of action of the anticoagulant was to inhibit the action of antihemophilic globulin. This was further substantiated by the in vitro inhibition of the ability of antihemophilic globulin to accelerate the coagulation time of ordinary hemophilic blood.

A hypothesis is presented to explain the appearance of the anticoagulant. It is believed that these 2 hemophiliacs are deficient in or lack antihemophilic globulin in their blood, and hence repeated injections of the globulin either in the form of whole blood, plasma, or Fraction 1 of Cohn resulted in "isoimmunization" against the injected globulin. The resulting antibodies inhibited any antihemophilic globulin which may then have been injected, which explains the refractory state exhibited by these 2 cases. Blood from these patients containing these antibodies likewise exerted an anticoagulant influence when added to normal blood by the same mechanism.

It is significant that the transfusion of washed red cells resulted in improvement in both of these cases.

LEROY J. KLEINSASSER, M.D

Studies on the Enigma of the Hemostatic Dysfunction of Hemophilia. ARMAND J. QUICK and WILLIAM F. STAPP. *Am. J. M. Sc.*, 1947, 214: 272.

The deficient factor in hemophilia is thromboplastin. Gradually evidence has been accumulated that the deficient factor in hemophilia resides in the plasma rather than in the platelets as formerly thought. Fundamentally, it is shown that the defective hemostasis of hemophilia is due to a lack of available thromboplastin in the blood. The prothrombin is normal both qualitatively and quantitatively, but because of the lack of thromboplastin in hemophilic blood, little prothrombin becomes converted into thrombin. This is shown to be a fact as little prothrombin is consumed in the coagulation of hemophilic blood. It is emphasized that the determination of the consumption of prothrombin offers the first promising means for assaying the thromboplastic activity of the blood. Normal plasma contains enough available thromboplastin to convert from 80 to 90 per cent of the prothrombin to thrombin. By giving a hemophilic patient a plasma transfusion, enough thromboplastin can be supplied to maintain effective hemostasis for 24 to 48 hours.

The coagulation time is of limited value as a measure of hemostatic effectiveness, particularly as a guide to the prothrombin level. In the case of hemophilia the coagulation time is a somewhat better guide, but unfortunately even in this condition a temporary reduction of the clotting time to normal does not necessarily assure good hemostasis.

The results obtained in the present investigation clearly show that the platelets are essential for coagulation since they appear to be required for the activation of the thromboplastin which is present in the plasma in an inactive form. It appears that on disintegration the platelets liberate an enzyme which acts specifically on the precursor of thromboplastin, thromboplastinogen. Hemophilic platelets would thus be normal in function, but have no thromboplastinogen to convert. As soon as this material is supplied by the transfusion of normal plasma, the hemophilic platelets react and daily normal coagulation is established.

The agglutination and disintegration of platelets appear to be contingent upon the formation of thrombin. In hemophilic blood, in which the production of thrombin is minute, the platelets remain unaltered. This suggests that the production of thrombin is related to platelet disintegration and it may well be that the following chain reaction is set up: formation of thrombin brings about the disintegration of platelets, which in turn makes more thromboplastin available to form more thrombin. The coagulation of normal blood which is characterized by a latent period followed by rapid conversion of fibrinogen to fibrin strongly suggests such a chain reaction. LEROY J. KLEINSASSER, M.D.

Denatured Calf Plasma for Transfusion. J. MĚLKA, V. RAPANT, and B. ZAPLETAL. *Lancet*, Lond., 1947, 2: 382.

To replace human plasma for transfusion, calf plasma must have its antigens removed. Such plasma, without its antigens, is called denatured calf plasma (D.C.P.) by the authors. To remove the antigens the calf plasma is treated with formal and heat. A change in the appearance of the calf plasma during this process (it becomes opalescent when viewed against a dark background), is important in the proof that the plasma has been denatured. The denatured calf plasma is then refrigerated in sterile containers, and it lasts almost indefinitely.

The author's laboratory research proved the following facts:

1. Denatured calf plasma does not contain agglutinins for human blood corpuscles of groups A, B, or AB.

2. It never hemolyzes human red corpuscles.

3. It does not produce precipitins against the proteins of denatured calf plasma or of natural calf serum in guinea pigs, rabbits, or in the human being.

4. With denatured calf plasma we cannot sensitize guinea pigs so as to produce anaphylactic shock after the injection of calf serum or denatured calf plasma. The authors confirmed Masson's work as to the harmlessness of infusions of denatured calf plasma.

Blood and plasma are more valuable than saline infusions in combating shock because of their colloid osmotic proportion. The authors demonstrated that the denaturing process does not reduce the colloid osmotic pressure of the denatured calf plasma proteins. They also showed that denatured calf plasma is not excreted in the urine even after repeated administrations.

The authors believe that the incidence of intolerance in blood transfusions, which intolerance occurs despite every precaution, can be reduced by the use of denatured calf plasma. However, the chief advantage of denatured calf plasma is its easy availability and low cost. Transfusions of this substance are recommended whenever there is a shortage of blood donors and whenever it is preferable to give plasma instead of whole blood.

JAMES WEAVER, M.D.

MISCELLANEOUS

The Origin and the Physiology of Heparin; The Specific Therapy in Thrombosis. J. ERIK JORPES. *Ann. Int. M.*, 1947, 27: 361

Heparin is a mucopolysaccharide resembling the chondroitin sulfuric acid of cartilage. The strongest samples contain 26 per cent of a uronic acid and about 23 per cent of glucosamine. These components make up 90 per cent of the organic structure of heparin. Heparin contains ester sulfuric acid, not only one group to each disaccharide unit but three groups, which make up not less than 45 per cent of the weight of the free acid. The uronic acid in heparin is claimed to be glucuronic acid. It is unknown whether heparin contains an acetyl group. There is no free NH_2 group. Acetic acid cannot be obtained from heparin except in much smaller quantities than would be calculated. The amount obtained by ordinary methods might come from impurities. It is unknown whether heparin is a definite chemical compound or whether it is a mixture of disulfuric and trisulfuric acid esters of one and the same polysaccharide, having a composition similar to that of Karl Meyer's hyaluronic acid. All types of polysaccharides acquire anticoagulent properties if thoroughly esterified with sulfuric acid. Heparin has a high molecular weight and carries an exceptionally strong negative charge. The high content of esteric sulfuric acid is the outstanding feature in its structure. The anticoagulant activity is probably exerted through the electric charges of the high molecular polysaccharide.

Heparin acts on the components of the coagulation system—on the thrombin, prothrombin, and the thrombokinase. It neutralizes the serum complement interfering with the Wassermann reaction. In higher concentration, it influences the sedimentation rate through the plasma proteins. Its multiplicity of action is probably an expression of the effect of the acidic polysaccharide on different proteins. The interaction of heparin and thrombin is easily reversible. Protamine instantly abolishes the heparin effect by neutralizing its negative electric charge. Protamine sulfate, from 50 to 100 mgm., can be injected intravenously in man in 1 per cent solution and brings the coagulation time instantaneously down to normal. Various animal heparins with the same content of ester sulfuric acid have various anticoagulant strengths—a fact difficult to explain. In spite of a strong ionic dissociation, heparin exerts an extremely low osmotic pressure in aqueous solution. This is a protective mechanism whereby heparin producing cells are protected from disruption by water flowing to establish osmotic equilibrium. This also makes heparin useful in blood analysis because it does not cause red corpuscles to shrink.

Heparin gives an extraordinary strong purple violet stain with certain blue basic dyes. One of these is toluidine blue which stains only high molecular esters of sulfuric acid a purple violet. The mast cells stain in this way with toluidine blue. They have a characteristic perivascular position. They are able thus to void their granular contents almost directly into the blood stream. They follow the capillaries and are thus rich in inflammatory tissue. Among the victims of Hiroshima, who showed a general bleeding tendency, there was a general increase in the mast cells in their tissues. Hyperheparinemia has been produced with an increase in mast cells by irradiation in dogs. Urticaria pigmentosa with multiple petechiae in the skin is a disease with abnormal accumulations of mast cells in the skin. It is now known that the mast cells produce heparin.

Heparin is clinically used in cases of thrombosis to influence the coagulation time. It can be used postoperatively to prevent thrombosis and embolism. Prophylactic use of anticoagulants is made difficult by their expense and by the tendency of patients to bleed from their operative site. However, they should be used postoperatively or after childbirth when there is a previous history of thrombosis. The author cites data showing that heparin shortens the course of thrombosis of the leg and decreases the incidence of later complications, such as edema. Heparin effects need not be checked by blood analysis except in special cases—as in elderly people with impared renal function. Heparin and dicumarol often have quite a specific effect in protracted nonvirus pneumonias which are resistant to antibiotics. Latent pelvic thrombosis producing pulmonary emboli is more common in these cases than is suspected. Anticoagulants will be useful in preventing clotting in the capillaries in various diseases. The author cites a case wherein heparin cleared up an anuria following a transfusion of incompatible blood.

JAMES WEAVER, M.D.

The Use of Dicumarol as an Anticoagulant; Experience in 2,307 Cases. EDGAR V. ALLEN, EDGAR A. HINES, JR., WALTER F. KVALE, and NELSON W. BARKER. *Ann. Int. M.*, 1947, 27: 371.

The expert use of the anticoagulants, heparin and dicumarol, has improved tremendously the outlook for patients who have acute vascular thrombosis.

An over-all consideration of 1,513 postoperative patients treated with anticoagulants indicates that the following results were achieved:

Eighty-five patients survived who would have been expected to die from pulmonary embolism; 250 patients were spared venous thrombosis or nonfatal pulmonary embolism. In 506 additional postoperative cases in which dicumarol was used prophylactically, venous thrombosis occurred in but 2 instances; there was no pulmonary embolism.

A consideration of 298 medical patients indicates that fatal pulmonary embolism was prevented by anticoagulants. Nonfatal pulmonary embolism and venous thrombosis occurred very infrequently. A study of 50 cases of acute myocardial infarction indicates substantial reduction in the incidence of further myocardial infarction and in arterial embolism and venous thrombosis. Survival of the extremity occurs in 91 per cent of cases of arterial embolism and in 81 per cent of cases of arterial thrombosis, if treatment with anticoagulants is begun early and supplemented by other treatment.

Our experiences indicate clearly that the anticoagulants are effective in the treatment and prevention of vascular thrombosis of medical patients just as they are effective in the care of postoperative patients with these conditions. Fatal pulmonary embolism can be prevented and venous and arterial thrombosis can be halted in most instances. Early treatment of sudden arterial occlusion with anticoagulants and other measures results in survival of the extremity in 90 per cent of instances of embolism and 80 per cent of instances of thrombosis.

In general, the use of anticoagulants constitutes the greatest contribution to the successful treatment and prevention of intravascular thrombosis and embolism.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Intravenous Oxygen and Pulmonary Embolism. JACK H. SANDERS and ISADORE M. ISOE. *Ann. Surg.*, 1947, 126: 208.

Because of the controversial state of reports in the literature on intravenous oxygen administration for the treatment of shock, the authors have made a study of the effects of the administration of intravenous oxygen on 2 patients in shock and on 4 patients who were observed to be in a fairly stable cardiorespiratory condition. One experiment was done with the use of 50 c.c. of venous blood drawn from a dog, and by noting the oxygen saturation produced in vitro. Studies showed that after the passage of oxygen bubbles through venous blood at rates comparable to intravenous administration, the blood failed to show any appreciable absorption. The authors concluded that gas bubbles coalesce in the veins, become of considerable diameter by the time they reach the pulmonary arteries, and may occlude the smaller arteries. The resulting gaseous embolism causes a decreased pulmonary circulation, arterial hypoxemia and systemic hypoxia, and these effects probably are intensified by reflex pulmonary spasm and bronchospasm. The authors state also that the present status of intravenous oxygen as a therapeutic measure is doubtful and, because of the possibility of pulmonary embolism, is hazardous. It is thought that some of the ill effects of pulmonary gaseous embolism might be alleviated by the administration of atropine and papaverine before intravenous oxygen is given. A state of shock or of anesthesia may also diminish these reflexes.

W. FOSTER MONTGOMERY, M.D.

Clinical Evaluation of Bovine Serum Albumin as a Blood Substitute. DAVID STATE, FELIPE TORRES ROMERO, MANUEL MORENO CASTELLANOS, and OWEN H. WANGENSTEEN. *Surgery*, 1947, 22: 424.

The authors made use of highly purified bovine serum albumin fractions obtained by the precipitation of bovine plasma by ethanol alcohol at -5°C. Four hundred and sixty-nine injections were made into 410 patients with 12 (2.9 per cent) immediate reactions and 38 (9.2 per cent) delayed reactions. There was therefore a marked reduction in the incidence of immediate and delayed reactions attending the use of purified bovine serum albumin fractions.

The immediate reactions were of 2 types: (1) The anaphylactoid, which was characterized by dyspnea, cyanosis, and fall in the blood pressure, and (2) the pyrogenic, characterized by chills and fever. In the main, the reactions were moderately severe. The onset of the delayed reactions was usually from 12 to 24 days after the injection and was characterized by urticaria, erythema, myalgia, arthralgia, and fever. In the severe cases, there were petechiae and ecchymoses. The incidence of both immediate and delayed reactions was no greater in patients who received multiple injections than in those who received a single injection.

Procaine given intravenously (1 gm. in 200 c.c. of saline solution over an interval of one hour) is a very effective agent in the treatment of delayed serum sickness. In concentrated solutions (25 per cent), bovine serum albumin would appear to be an effective agent in the prevention and treatment of shock. For a large blood loss (in excess of 80 c.c.), blood obviously would be a more satisfactory agent with which to combat shock. Because of the persistence of, and incapacity caused by, the delayed reactions, crystallized bovine serum albumin is not recommended at present as an ideal blood substitute.

C. FRED GOERINGER, M.D.

Changes in Plasma Volume and Mean Arterial Pressure after the Intravenous Injection of Concentrated Human Serum Albumin in 38 Patients with Oligemia and Hypotension. ALICE LOWELL, ANDRE COURNAND, and DICKINSON W. RICHARDS, JR. *Surgery*, 1947, 22: 442.

The authors have studied the intravenous use of concentrated human serum albumin to determine the efficacy of this agent in assisting the recovery from shock and shocklike conditions. The present article is concerned primarily with a comparison of the effects upon mean arterial blood pressure and plasma volume of the intravenous injection of concentrated human albumin solutions when given with or without additional intravenous fluids.

It was determined that the intravenous administration of concentrated albumin solution, with or without additional fluid, was free from untoward clinical reactions as evidenced in two groups of patients (18 in one group and 20 in the other), one receiving concentrated albumin without, and the other receiving concomitant solution with, additional fluid. The injection of concentrated human solution alone (without concomitant saline solution) was associated with an immediate increase in plasma volume of about 12 c.c. per each gram of albumin injected and retained, and a fall in the hematocrit. Since the expected in vitro value is 18 c.c. per gram of albumin, it appears that the albumin retained did not hold a volume of fluid commensurate with its theoretic osmotic activity. However, the intravenous injection of 400 c.c. of isotonic saline solution along with the albumin resulted in a somewhat greater increase in plasma volume per gram of albumin, both injected and retained, the average being 16 c.c., which compares more favorably with the theoretic value of 18 c.c.

Patients in severe shock, presumably with continuing blood or plasma loss (burn or peritonitis),

showed much smaller increases in plasma volume per gram of albumin given and retained, namely, an 8 c.c. average in shock against a 14 c.c. average in nonshock patients.

The administration of 100 c.c. of concentrated albumin (25 per cent) without additional fluid corresponds to about 200 c.c. of plasma.

In 25 per cent of the cases studied the total circulating protein, after the injection of albumin, was significantly greater than expected. This increase suggests the possibility that during recovery protein may be mobilized from body reserves, or that blood, in static pools during the hypotensive period, may be returned to the circulating blood as the general circulation improves.

There was noted a rise in intra-arterial blood pressure (average, 17 mm. of Hg.) in both groups of patients but the blood pressure failed to reach accepted normal levels. Hemodilution with its decrease in blood viscosity may account, at least in part, for the failure of the blood pressure to rise to accepted normal levels. A stationary or falling blood pressure with a rapid increase in plasma volume after the intravenous injection of albumin may indicate failure in vasomotor tone. ROBERT TURELL, M.D.

The Use of a Mixture of Pure Amino Acids in Surgical Nutrition. SIDNEY C. WERNER. *Ann. Surg.*, 1947, 126: 169.

A careful clinical study was made with a metabolism ward set-up at the Presbyterian Hospital, in New York. The authors concluded that the healthy adult remains in nitrogen equilibrium except for minor daily fluctuations. Their data indicates that no excesses of nitrogen appear in the urine when nitrogen is withheld postoperatively and that the nitrogen excretion may be less than that of an uninjured patient on the same intake. High carbohydrate regimens spared nitrogen, which would be unlikely if the nitrogen loss were the result of toxic destruction of tissues, as suggested by others. It was thought that there was no increased rate of catabolism or tissue destruction in the absence of nitrogen intake. Contrary to the anabolism theory, the authors believe that the incoming nitrogen is not entirely wasted and a high nitrogen intake lessens or reverses negative nitrogen balance after trauma. The authors assume that there is an increase in the rate of both anabolism and catabolism.

The use of protein hydrolysates for parenteral nutrition has been shown to have certain practical difficulties. A satisfactory protein substitute is still desirable and a mixture of pure amino acids, "VUJ," was given clinical trial. This mixture of pure amino acids in 10 per cent and 8 per cent solution was used clinically. Seventy-three patients received the 8 per cent solution which seemed the more satisfactory; few toxic effects were noted with the 8 per cent solution. In the series, only 1 death of obscure origin was reported. It was feasible to give up to 1,500 c.c. of the amino acid solution twice daily to provide 28.8 gm. of nitrogen.

For evidence of increased catabolism, if nitrogen has not been given after the injury, the authors include three conditions which are necessarily present in addition to injury; namely, the presence of incoming nitrogen, inanition, and severity of injury.

Twenty patients with peptic ulcer and 1 patient with lymphoma of the stomach were submitted to partial gastric resection and given the pure amino acid preparation during the postoperative period. A similar series of 29 cases served as controls. A fifth of the controls appeared to do less well than the amino acid-treated patients. It was pointed out that the results in the two groups were similar enough to suggest that possibly unconsidered postoperative therapy with amino acids may be unnecessary. Clinical benefit criteria were tabulated. Complications and the length of hospital stay were thought lessened with the administration of amino acids. The return to normal temperature after operation appeared sooner. Abdominal distention and postoperative edema of the stoma showed a higher incidence without treatment. The treated patients appeared to be stronger than the controls. Appetite and ability to eat a bland diet may have been improved with amino acid therapy.

W. FOSTER MONTGOMERY, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Frostbite. KURT LANGE, DAVID WEINER, and LINN J. BOYD. *N. England J. M.*, 1947, 237: 383.

The physiology of frostbite is characterized by blanching followed by a pinkish discoloration of the involved part. The thawing phase further intensifies the discoloration, to which is added swelling and temperature elevation. During this period blister formation is pronounced and is rapidly followed by vesicle rupture. If the blister fails to rupture it forms a dense gelatinous adherent mass on a red inflammatory base. Sensation to pin prick, heat, and cold is lost. Within a period of 3 to 10 days well demarcated areas of gangrene appear. The intravenous injection of fluorescein during the acute phase of frostbite in the experimental animal is characterized by a total absence of fluorescence. During the thawing period hyperfluorescence is marked because of the increased blood flow and capillary permeability. This is followed again by another phase, 48 to 140 hours after cooling, during which the part is completely nonfluorescent as a result of vascular occlusion and the onset of gangrene. Microscopy of the capillaries reveals the clumping of circulating red cells as the basic phenomenon of vascular occlusion. During the thawing period the cell masses break up and the red cells resume their independence. When this fails to occur the agglutinative thrombi of red cells may undergo complete hyalinization after from 3 to 8 days. The escape of plasma protein into the interstitial spaces is followed by fibrinization of the clot with subsequent fibrosis and collagen formation described as lardaceous inflammation.

Animals subjected to cooling experiments and heparinization failed to develop gangrene, whereas all the animals in the control group developed gangrene under similar conditions. Of great significance in the former group was the absence of agglutinative thrombi and hence the inhibition of gangrene by heparinization. A series of similar experiments were made on human volunteers.

The following tests were made: the effect of topical freezing, freezing with immediate heparinization, heparinization delayed for 24 hours after freezing, interim cooling and interim warming combined with heparinization. Untreated freezing caused gangrene. Immediate and early heparinization gave the best therapeutic results, the blister fluid did not clot and fibrosis did not develop. Interim cooling and warming created a more intense type of gangrene than that caused by freezing alone. Recommended for the treatment of frostbite is the intravenous administration of a total of 300 mgm. of heparin in 2,000 c.c. of normal saline for a 24 hour period delivered at the rate of 20 to 25 drops per minute. Heparin in Pitkin's menstruum is not recommended because of pain associated with its injection. Clotting time is checked by the Lee and White method at 12 hour intervals with blood coagulation maintained between 30 to 60 minutes. Treatment should be maintained for 6 to 7 days. Resulting surgery is limited and conservative.

BENJAMIN G. P. SHAFIROFF, M.D.

Grafts of Skin and Cartilage. JAMES BARRETT BROWN, BRADFORD CANNON, CARL E. LISCHER, and W. BOWDOIN DAVIS. *J. Am. M. Ass.*, 1947, 134: 1295.

Composite free grafts from the ear, comprising two surfaces of skin with cartilage between have proved increasingly useful in the replacement of tissue lost from the nasal tip, nostril borders, and columella. The use of free transplant has made it possible to perform repairs in a single procedure with minimal deformity to the ear and has eliminated the need of multiple procedures in moving distant flaps.

The length of the graft is not limited but it is doubtful whether grafts over 1 cm. in width can be successfully transplanted. The columella, tip, and one ala of the nose can be restored with a single graft. To correct a short ala, the alar scar can be opened and a wedge-shaped graft inserted; or a constricted nostril due to a burn can be opened by excision of the scar and repaired with a composite graft. Adequate minute blood supply with as much well vascularized surface as possible available for contact between the nose and the graft is necessary in preparation of the defect for the graft.

A pattern of the final defect is helpful in selecting a suitable part of the ear for the donor area and accurate measurement of the graft.

Portions of the normal ear with thin skin over the cartilage are best. If a long or wide graft is necessary, the rim of the helix is the only possible source. Separation of cartilage from skin should be avoided. Repair of the ear in large excisions requires a scalp flap in which the open ear is buried. Smaller excisions can be repaired by direct closure or by local flap and graft.

The graft is accurately sewed in place. In dressing, adequate immobilization is secured by packing the nostrils and applying gentle but firm external pressure.

LOUIS T. BYARS, M.D.

Acute Subpectoral Abscess: A Surgical Emergency. KNOWLES B. LAWRENCE and THOMAS J. ANGLEM. *N. England J. M.*, 1947, 237: 390.

Expectant treatment and delay in the surgical treatment of subpectoral abscess may lead to extensive tissue destruction and axillary abscess. More serious complications such as subscapular space infection, empyema, mediastinitis, and septicemia may develop. Sulfonamide therapy and other antibiotics are only delaying in action, whereas early surgical drainage is essential in all cases.

Subpectoral abscess is characterized by a minor infection of the upper extremity, leading to suppuration of the infraclavicular lymph nodes located along the subclavian and axillary vessels lateral to the anterior scalenus muscle. Suppuration may extend through the axillary fascia, the fascia of the scapular space, or may follow the vascular pathways to the arm or mediastinum. Relatively high pressures may develop in the subpectoral space before rupture occurs into the surrounding fascial spaces. Edema of the overlying muscles contributes to the swelling of the area and the severity of the pain. The primary focus is frequently an insignificant infective lesion of the middle finger, a lesion on the chest wall, or in the shoulder area.

Clinical manifestations consist of pain in the shoulder area that progresses in intensity, and motion becomes limited and painful. If the infecting organism is the streptococcus the patient is acutely ill and toxic. Tenderness and swelling is present in the subpectoral region, the shoulder, the axilla, and the supraclavicular fossa. Signs of fluctuation cannot be elicited until late, when the suppurative process has ruptured through the axillary fascia. Differential diagnosis involves the shoulder joint and its bursae.

Treatment should be directed at early incision and drainage of the subpectoral space even in the absence of frank suppuration. The incision should be made in the axillary fascia at its line of fusion with the lateral margin of the pectoralis major muscle. The skin incision is made at right angles to the anterior axillary fold. After exposure the forefinger is used for blunt dissection high up into the space as far as the anterior scalenus muscle and the axillary structures. Counter incisions may be made to secure dependent drainage.

BENJAMIN G. P. SHAFIROFF, M.D.

Streptomycin Therapy in 52 Cases of Bacterial Infection. LEWIS W. KANE and GEORGE E. FOLEY. *N. England J. M.*, 1947, 237: 531.

The authors report 52 cases of bacterial infection treated with streptomycin. Urinary infections, in-

cluding 38 cases of pyelonephritis and 2 cases of cystitis, made up the bulk of the cases. All of the infections were due to the gram negative bacilli and were treated with intramuscular streptomycin given on a 4 hour schedule. The total daily dose ranged from 0.5 to 2 gm. and was continued for 3 days after the urine became sterile. Most important, because of the fact that streptomycin is most effective in an alkaline medium, the urine was alkalinized in the majority of the cases. One teaspoonful of a 50 per cent solution of sodium citrate 3 times a day was usually sufficient. In the presence of pulmonary or peripheral edema, potassium salts were substituted for sodium citrate. Thirty of the 40 patients with urinary infection had sterile urine for 1 week after therapy was discontinued and were considered to be cured. Only one questionable relapse was found in this group. Moderate structural damage, such as dilated calyces, slight hydronephrosis, partial stricture of a ureter, or small nonobstructing calculi did not seem to preclude a cure if the infecting organism was sensitive. The authors attribute their better results as compared to those reported by other workers to the alkalinization of the urine.

In addition, 3 patients with nonspecific urethritis were given streptomycin therapy with good results. Four patients with Haemophilus influenzae infections were likewise treated with excellent results. In the 2 cases of Haemophilus influenzae meningitis from 0.05 to 0.1 gm. of streptomycin was given intrathecally. Three patients with bronchiectasis were treated with streptomycin and penicillin aerosol, but only 1 patient was thought to have been benefited. A case of lung abscess due to Haemophilus influenzae showed marked improvement under this therapy, and recovery of a patient with Pseudomonas aeruginosa septicemia was effected.

F. J. Lesemann, Jr., M.D.

Polymyxin: A New Chemotherapeutic Agent. P. G. Stansly, R. G. Shepherd, and H. J. White. *Bull. Johns Hopkins Hosp.*, 1947, 81: 43.

Polymyxin is a new antibiotic substance derived from the Bacillus polymyxa. Its potency is assayed as that unit of activity which is equivalent to the amount of polymyxin per milliliter which just inhibits the growth of Escherichia coli, MacLeod strain. Polymyxin is a white, water soluble powder with a *p*H of 5 in aqueous solution. It is relatively stable in dilute acid alcohol solutions and to heat. Also, it is not affected by prolonged incubation with pepsin, trypsin, or pancreatin.

In vitro, by the agar streak method, from 0.5 to 16 micrograms of polymyxin per milliliter inhibit 56 of 64 strains of gram negative bacteria. This antibiotic is particularly effective against virulent strains of Klebsiella pneumoniae or Pasteurella multocida. A single dose of 10 micrograms per 20 gram mouse is sufficient to protect practically all the inoculated mice against the Klebsiella pneumoniae. Chickens injected with a fatal strain of fowl typhoid can be protected by the daily injection of an average of 16 mgm. of polymyxin per kilogram of body weight.

Polymyxin is effective subcutaneously and intravenously. For oral potency the drug must be increased to 64 times the parenteral dose. The formaldehyde bisulfite derivative of polymyxin causes no local irritation, even when injected in 15 per cent solution. It is not toxic, even when injected in 100 milligram doses for a period of 30 days.

Benjamin G. P. Shafiroff, M.D.

ANESTHESIA

Skin Temperature as a Clinical Aid during Anesthesia. J. Clutton-Brock. *Proc. R. Soc. M.*, Lond., 1947, 40: 607.

Skin temperature readings are used to distinguish between falls in the blood pressure which are due to shock and those which are due to other causes of little significance. The combined fall of skin temperature and blood pressure readings predict the patient's need for resuscitation.

A mercury in glass thermometer is used which reads from 80 to 170° F. The ring bulb is attached by elastoplast to the patient's forehead, and changes in temperature rather than absolute readings are considered to be of significance. After an initial rise during the induction of the anesthesia, the temperature of the skin will remain steady unless shock occurs. A fall of 3 degrees or more is believed to show a considerable degree of shock. A marked fall in blood pressure can occur without a fall in skin temperature when the low blood pressure is due to any cause producing sluggishness of the circulation without true shock, such as a high spinal anesthesia or changes in position of the patient. The author has never found any harm to come to a patient when the blood pressure fell without a concommitant fall in the skin temperature. When, however, the blood pressure and skin temperature fall together, the patient needs energetic resuscitation.

Edith Eason, M.D.

Intravenous Procaine: A Preliminary Report. David J. Graubard, Raphael W. Robertazzi, and Milton C. Peterson. *N. York State J. M.*, 1947, 47: 2187.

This report deals with the intravenous use of procaine hydrochloride for the control of pain in traumatic and inflammatory conditions. There were no serious ill effects in 140 cases with 608 infusions.

The physiology and pathology of inflammation and the pharmacology of procaine are reviewed. The authors believe that in traumatized or inflamed areas procaine administered by the intravenous route has a twofold action: (1) direct action on the irritated nerve fibers, and (2) indirect action of the diethylaminoethanol on the endothelium of the blood vessels.

To simplify the work, the term "procaine unit" was devised. This is the amount of procaine calculated at 4 mgm. per kgm. of body weight to be given

in 20 minutes in a 0.1 per cent isotonic saline solution. For accurately determining the dosage and for a constant uniform rate of administration, a flowrator was utilized.

Typical signs and symptoms as observed during the administration consist of a sensation of warmth throughout the body; a flush over the head, face and neck; dryness of the mouth; dilatation of the pupils; and lightheadedness. Many patients feel comfortably relaxed with the alleviation of pain. The authors strive not to exceed these manifestations during the administration of procaine. They have noted no cases of procaine sensitivity or any contraindications to the use of this drug.

The results in the management of pain in trauma have been uniformly good, except for the cases of herniated intervertebral disk. The inflammatory cases on the whole responded well. In the miscellaneous cases, the results were relief of spasm, increased mobility, and improved muscular control.

It was concluded that:

1. Intravenous procaine infusion for the management of pain in trauma and inflammatory conditions is a safe hospital procedure, provided that the administration is controlled.

2. The indiscriminate and careless intravenous administration of procaine may prove dangerous.

3. Intravenous administration of procaine should be considered as an adjuvant to the management and treatment of selected traumatic, inflammatory, and spastic conditions. MARY FRANCES POE, M.D.

Pseudomonas Pyocyanea Meningitis following Spinal Analgesia. IAN M. DAVIDSON. *Lancet*, Lond., 1947, 2: 653.

The author points out that the conscientious recording of cases of meningitis following spinal analgesia is important in order to emphasize the possible dangers of the method.

In one day, the repair of 3 hernias was carried out under spinal analgesia. The first patient made an uninterrupted recovery. In the 2 others Pseudomona pyocyanea meningitis developed. One of these patients recovered after treatment with sulphamerazine; the second died.

An exhaustive attempt to trace the source of the infection in these cases was without success. In a similar case not reported here, the source was so-called sterile water in the operating theater.

Emphasis is laid on the importance of a rigid technique of asepsis in lumbar puncture, whether for diagnostic or anesthetic purposes.

MARY FRANCES POE, M.D.

Discussion on Anesthesia for Cesarean Section. RUFUS C. THOMAS, J. H. PEEL, C. MCINTOSH MARSHALL, KATHERINE LLOYD-WILLIAMS, and Others. *Proc. R. Soc. M.*, Lond., 1947, 40: 557.

THOMAS. The essential criteria for any anesthetic for a cesarean section must be safety for the mother and child and, subject to this, ease of operating for the surgeon. The discussant has used heavy nupercaine for many cesarean sections during the past 9 years. The arguments against spinal anesthesia for the pregnant woman are: (1) it should not be used for patients with severe anemia and low blood pressure; (2) a number of cases of meningitis, some of them fatal, have followed spinal anesthesia; and (3) postoperative headache is not an infrequent occurrence.

Some advantages of spinal anesthesia with heavy nupercaine include: (1) it is relatively painless; (2) the anesthetic has no effect whatever on the baby; and (3) the surgeon has maximum relaxation for the operative procedure. The technique should be strictly and rigidly aseptic. The amount of heavy nupercaine used is 2 c.c. given between the third and fourth lumbar vertebrae. This series includes 346 cesarean sections under heavy nupercaine anesthesia. There were no deaths. The infant mortality rate was 3.4 per cent; 2 were stillborn, and 10 died.

PEEL. A brief résumé of 51 cesarean sections done under continuous caudal is given. There was no maternal mortality and no higher incidence of morbidity than is experienced in any series of cesarean sections. The advantages of continuous caudal anesthesia are enumerated.

MARSHALL. There are several reasons why inhalation anesthesia is unsatisfactory and dangerous for cesarean section. Accidents may occur during induction because of the light anesthesia with little if any preoperative medication, which will cause vomiting and aspiration of the stomach contents into the bronchial tree. Furthermore, most of the inhalation anesthetics induce some degree of anoxia.

The only justifiable choice lies between spinal and local anesthesia when certain complications of labor have occurred. Spinal anesthesia is without effect on the fetus. Interest is increasing in local anesthesia for cesarean section, although it is not likely that many obstetricians will ever extend it to the majority of their patients. The discussant makes a plea that local anesthesia should be considered for the poor risk patient. One word of warning is given to the effect that with an uncorrected transverse position the lower uterine segment should never be opened under local anesthesia alone. If the back or the shoulder and arm fall into the wound, extraction may be almost impossible.

LLOYD-WILLIAMS. The discussant gives an account of her wide experiences with anesthesia for cesarean section which dates from 1928 to the present time. Having tried most all forms of anesthesia she now prefers pentothal with gas and oxygen, adding trilene, vinyl, or ethyl ether in minimal amounts. She does not recommend spinal anesthesia although it was used in 85 of her series of 204 cases.

DAWKINS. In this author's series of cases epidural anesthesia has given the most satisfactory results. The technique of this block is as follows:

A skin wheal is made between the second and third lumbar vertebrae and a Howard Jones spinal needle inserted in the midline. Odom's glass indicator containing an air bubble is attached and the needle is very slowly advanced into the ligamentum flavum

until the air bubble is sucked in toward the patient by the negative pressure in the epidural space. Forty-five cubic centimeters of 1:600 nupercaine in 0.45 per cent normal saline solution are used. Ten cubic centimeters are given slowly as a test dose, after it is certain that no cerebrospinal fluid can be withdrawn. After an interval of 5 minutes a further 35 c.c. of nupercaine are injected slowly (again with aspiration several times). The needle is then removed and the patient lies on her back in a slight foot-down tilt. It usually takes 25 minutes for the analgesia to be complete. In the discussant's experience all the babies breathed spontaneously at birth and there were no headaches, chest complications, or urinary problems. Vomiting was almost negligible.

CAVE. Under spinal anesthesia the surgeon can proceed with cesarean section at whatever pace he likes, safe in the knowledge that the fetus is not being affected. Furthermore, the muscular relaxation will be good, and there will be minimum risk of postpartum hemorrhage.

SMITH. This discussant has had wide experience with local anesthesia for cesarean section and finds it the anesthetic of choice. EDITH EASON, M.D.

Curare: Its Past and Present. STUART C. CULLEN. *Anesthesiology*, 1947, 8: 479.

This is a review of the history of curare and an investigation of the development of the preparations in clinical use today. Much is learned of the witchcraft and daily lives of the South American Indians and the exploits of the early explorers. It is also evident that although we are able to apply the drug satisfactorily in clinical practice, we have probably not extended the scope of its usefulness over that which has been proposed by the clinicians of the nineteenth century.

Clinical application was first attempted in 1866 by 2 French physicians who tried to allay and prevent the convulsions of epilepsy. Current enthusiasm for the clinical application of curare is largely due to the efforts of A. E. Bennett who popularized the use of curare in the control of convulsions associated with metrazol or electric shock therapy.

Bennett's exhibit at the 1940 meeting of the American Medical Association prompted several anesthesiologists to consider the possibility of using curare as a means of improving muscular relaxation during inhalation anesthesia. The rational and safe utilization of curare in anesthesiologic practice was defined by the anesthesiologists who were among the first to employ curare in volume. These fundamental principles emphasized that curare was to be used only as a means of providing muscular relaxation and that some anesthetic or analgesic agent must be administered to provide pain relief. It was emphasized that the drug was selective in action, and graded doses were recommended as being capable of producing the desired relaxation without interfering with the respiratory efficiency. It was emphasized that the principal advantage of curare in anesthesiology is to provide muscular relaxation and permit the anesthesiologist to effect anesthesia with low concentrations of potent anesthetic agents. It is also possible to extend the usefulness of impotent agents.

The laboratory investigations that accompanied the introduction of curare into anesthesiologic practice established the principle that the dose of curare is influenced by the anesthetic agent because some of the anesthetic agents have curariform properties of their own. Other research indicated that curare in therapeutic doses is capable of lowering the blood pressure in a few patients. It was determined further that curare does not alter cardiac rhythm, nor does it interfere with certain elements of tissue metabolism, but it does cause relaxation of the small intestine. The lack of anesthetic or soporific properties of curare has been pointed out.

To date there has been a minimum number of disadvantages and dangers accompanying the rational use of curare. It is obvious that means for providing prompt and efficient artificial respiration must be at hand when curare is administered. The indiscriminate employment of prostigmine to overcome the effects of the improper use of curare should be discouraged. The bronchospasm may be relieved by the administration of additional curare. In spite of laboratory and considerable clinical evidence that curare has little or no influence on the heart and peripheral circulation, it appears that large doses for long periods may cause a deterioration of the peripheral circulation.

Curare has secured a respectable position in the compendium of therapeutic agents. There is much that curare can do to enhance the knowledge of fundamental physiologic processes. It can be anticipated, however, that this jungle poison will justify the faith in it that all its ancient and contemporary patrons have had. MARY FRANCES POE, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Iodinated Organic Compounds as Contrast Media for Radiographic Diagnoses. Experimental Studies on Emulsions of Ethyl Iodophenylundecylate (Pantopaque). WILLIAM E. CHALECKE, GLENN E. JONES, LEON L. MILLER, T. B. STEINHAUSEN, WILLIAM H. STRAIN. *Radiology*, 1947, 49: 131.

Ethyl iodophenylundecylate (pantopaque) forms stable aqueous emulsions. Such emulsions adhere to, and coat the mucosa and seem well adapted to the visualization of certain body cavities.

The addition of up to 1 per cent of a surface active agent such as oleyl methyl taurine (igepon-T-gel) and the passage of the mixture through a homogenizer produces a stable 50 per cent emulsion. After long standing this settles into a 70 per cent milky emulsion and a clear aqueous phase. The particle size is dependent upon the mode of preparation but is usually on the order of from 1.5 to 3.5 microns. The lethal dose (50 in mice) is unchanged with emulsification; however, in rats it drops from 19 to 2 gm. per kgm. for a 24 hour kill. (Rats appear to be particularly sensitive to ethyl iodophenylundecylate).

Excellent bronchograms were obtained with the 70 per cent emulsion in anesthetized dogs. The trachea as well as the smaller bronchioles were well visualized. By the seventh day the lung fields were roentgenographically clear. Autopsy studies of 4 of the 16 dogs used showed no deleterious effects attributable to the use of this medium.

The 50 per cent emulsion gave excellent visualization in retrograde pyelography and cystography. There was good to fair visualization of the wall of the pelves and calices after the bulk of the material had been eliminated. The autopsy findings in the dogs used in these studies was not remarkable.

Hysterosalpingography and cholangiography were also accomplished with satisfactory visualization and no evidence of damage.

Up to 1 c.c. per kilogram of the 50 per cent emulsion has been injected intravenously into dogs without immediate or subsequent ill effects.

The authors believe that this reagent offers some promise of clinical applicability especially in bronchography in which, because of the inherent properties of the emulsion, the films obtained more nearly resemble "mucosography" than the conventional bronchogram. R. B. LEWIS, M.D.

Iodinated Organic Compounds as Contrast Media for Radiographic Diagnoses. Visualization of Empyema Cavities with the Aid of Ethyl Iodophenylundecylate Emulsion. MURRAY P. GEORGE, EARLE B. MAHONEY, HERMAN E. PEARSE, and WILLIAM H. STRAIN. *Radiology*, 1947, 49: 137.

An emulsion containing 50 per cent ethyl iodophenylundecylate (15% iodine) was used to outline empyema cavities in 8 patients. Seven of the cavities were closed, and 1 was open. The roentgen visualization was very satisfactory. The emulsion coated the entire lining membrane without positioning of the patient; however, in the presence of a coagulum of pus the reagent tends to collect on the surface of the coagulum. Following the demonstration all of the opaque material is easily removed by saline lavage. R. B. LEWIS, M.D.

Iodinated Organic Compounds as Contrast Media for Radiographic Diagnoses. Studies on Tetraiodophthalinidoethanol as a Medium for Gastrointestinal Visualization. GLENN E. JONES, WILLIAM E. CHALECKE, JOSEPH DEC, JOHN A. SCHILLING, and Others. *Radiology*, 1947, 49: 143.

The deficiencies of barium sulfate as the contrast media in examination of the gastrointestinal tract are well known, especially in air contrast studies of the colon.

Experimental work on dogs as well as a limited clinical study revealed that tetraiodophthalinidoethanol adheres better to the bowel wall (as shown by air contrast studies), delineates experimentally produced gastric lesion more completely, (not to settle out as readily), is more palatable, and shows less tendency to inspissate than barium sulfate.

The medium contains 73 per cent iodine and is considerably more radiopaque than barium. Its preparation, however, is very time consuming. After micronization in the dry state, a suspension in which the particle size is from 1 to 2 microns is produced by grinding in a ball mill with water for several weeks.

The studies on toxicity are incomplete but it would appear to be of about the same order as that of barium sulfate. R. B. LEWIS, M.D.

Changes in the Lungs in 126 Cases of Asbestosis Observed in Finland. CARL WEGELIUS. *Acta radiol.*, Stockh., 1947, 28: 139.

Asbestosis is a form of pneumoconiosis caused by the inhalation of asbestos dust. This disease is frequently found in people associated with the asbestos industry. Asbestos denotes a number of mutually related magnesium silicates containing variable amounts of iron, lime, water, and bound silicic acid. Asbestos crystals are long, narrow, and sharp with a mean length of from 20 to 75μ and a thickness of from 0.5 to 2μ.

Inhaled particles enter the finer airways of the lungs as foreign bodies and are fixed in place by fibroblastic proliferation in a peribronchial fashion. Fibrosis leads to shrivelling "asbestos corns" and local emphysema.

Asbestosis is a diffuse interstitial peribronchiolitic fibrosis involving the bases, whereas silicosis is a nodular fibrosis of the middle two-thirds of the lung fields. Dumbbell bodies found in the lungs and the

sputum are due to the asbestos needle, and serve as a nucleus surrounded by a gelatinous coating.

The symptoms are dyspnea and irritating cough. In advanced stages, there are circulatory disturbances and hypertrophy of the right heart. Bronchopneumonia and bronchiectasis are secondary complications. Tuberculosis does not occur with asbestosis. The prognosis is not good, the average length of life being 15.2 years, whereas in silicosis it is 40.1 years. The time interval between exposure to the asbestos dust and development of the asbestosis is from 9 to 10 months.

The diagnosis of asbestosis is made by means of the clinical history and roentgenograms. It is divided into three stages. Stage 1 reveals a fine linear fibrosis in the basilar lung fields (Fig. 1). Stage 2 reveals nodules plus widened hila, but no lime layering. Stage 3 reveals marked confluent density in the bases and emphysematous apices.

One hundred and twenty-six cases are reported; 94 (75%) were stage 1, with an average mean exposure of 3.4 years; 23 cases (18%) were in stage 2, with an average mean exposure of 7.9 years, and 9 cases (7%) were in stage 3, with an average mean exposure of 11.5 years. MAURICE D. SACHS, M.D.

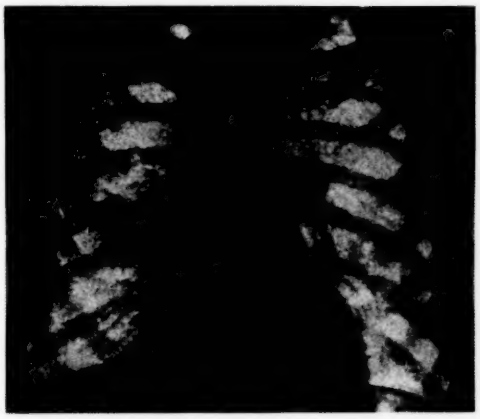

Fig. 1. (Wegelius) Asbestosis, stage 1. Fine network in the middle and basal fields of the lung picture, already layered with small soft spots. (See p. 304 for abstract.)

The Roentgenographic Diagnosis of Perforations of the Upper Gastrointestinal Tract into the Mediastinum and Pleural Cavity. GORDON J. CULVER and STANLEY B. CLARK. *Surgery*, 1947, 22: 458.

Esophageal perforation still carries an extremely high mortality rate. The prognosis depends in part on the location, perforations high in the esophagus having a better prognosis than those lower down. Moerl gave the following reasons for this: (1) a perforation in the cervical portion of the esophagus leads to inflammation in the mediastinum which has a tendency to spread upward where it is more accessible to surgery, (2) any inflammatory process in the upper mediastinum remains more circumscribed than one located lower down, and (3) the site of perforation can easily be reached also with the aid of the esophagoscope. The duration of the underlying pathology prior to the perforation has an additional influence. A long standing process is more apt to lead to a localized periesophagitis than a diffuse mediastinitis because of the time it had to produce a walling off of the inflammation. Perforations of the lower esophagus commonly rupture into the pleural cavity, with an invariably fatal outcome.

The perforations occurring higher in the esophagus may be due to foreign bodies, instrumentation, or some pre-existing lesion as, for example, diverticulum, ulcer, or carcinoma. In the lower esophagus, because of the weak wall, perforation may result spontaneously under increased pressure from vomiting, retching, or coughing.

The authors had the opportunity of observing 4 cases of perforation of the esophagus. Instrumentation was the cause in 2; in the third case there was a pre-existing peptic ulcer of the lower esophagus, and in the fourth an ulcer of the cardioesophageal junction. The cases are briefly described and illustrated with their respective roentgenograms. Three of the patients died shortly after the initial symptoms. The fourth patient experienced a perforation high in the esophagus with emphysema of the neck and mediastinitis, and recovered. In the 2 cases with pre-existing ulcers the perforations followed attacks of sudden vomiting, both patients having consumed alcohol prior to the onset of symptoms. Eliason and Welty, likewise, described 2 esophageal perforations which resulted from bouts of vomiting and retching after an alcoholic spree.

In 3 of the 4 cases reported by the authors the outstanding clinical manifestation was the resultant hydropneumothorax. In the fourth, the perforation was high in the esophagus and there was only mediastinitis present, from which the patient recovered.

The authors believe that a roentgenographic finding of hydropneumothorax associated with the clinical findings of sudden thoracic and/or abdominal pain, shock, and collapse should make one suspicious of perforation of the lower esophagus or stomach into the mediastinum and pleural cavity. A spontaneous pneumothorax is differentiated on the basis of the fact that no pleural effusion is present, or, if fluid forms, it does not appear until later. A review of the literature shows that most investigators considered the roentgen demonstration of hydropneumothorax, especially in the presence of some pre-existing lesion or a history of swallowing a foreign body or caustic fluid, as being diagnostic of esophageal perforation.

Several investigators gave contrast media by mouth in order to visualize the communication between the esophagus and pleural cavity. However, unless the perforation is located in the upper or cervical portion of the esophagus, such a procedure is dangerous. T. LEUCUTIA, M.D.

Roentgen Diagnosis in Epiphysiolysis (Coxa Anteverta). MAURICE M. POMERANZ. *Bull. Hosp. Joint Dis.*, N. Y., 1947, 8: 15.

The roentgenographic features of epiphysiolysis are reviewed. This condition is of more frequent occurrence and importance than is commonly recognized, and the author had observed approximately 500 cases up to the time of his report. For purposes of roentgenographic description and study he classifies the lesions as follows: (1) slight slipping; (2) moderate slipping; (3) extreme slipping, (a) acute, and (b) chronic; (4) long-standing examples.

The earliest distinctive sign of slight slipping, when present, is the loss of the "hump" formed by the projecting lip of the epiphysis. After 8 or 9 years of age, this normally extends slightly beyond the limits of the superior border of the femoral neck. Occasionally the only sign of the early stage of this condition is merely widening of the epiphyseal plate. On lateral projection there is beginning anteversion of the femoral neck. On anterior-posterior roentgenogram, there is a slight increase in the density of the base of the epiphysis which indicates that its position has already been altered by rotation. Under normal conditions, in many hips, the epiphyseal plate appears serrated. As the femoral head is detached, the serrations disappear and the plate surface of the epiphysis appears as a curved, fairly dense line parallel to the margins of the femoral neck. Roentgenographically the epiphyseal line is of increased width; there may be noted patchy, confluent, or roughly circular zones near the epiphyseal plate due to irregularities in contour of the epiphyseal surface of the anteverted neck.

In moderate slipping, the condition has advanced so that the capital epiphysis has slipped from one-eighth to one-half inch. As the epiphysis is detached, it rotates downward so that its widest diameter is nearly in a horizontal plane. It is slightly reduced in height. The head of the femur does not leave the acetabulum—it merely shifts its position within the socket. The epiphysis rotates backward and the anterior lip of the epiphysis migrates inward. As a result of anteversion, the femoral neck appears foreshortened and its upper extremity projects well beyond the limits of the superior pole of the epiphysis.

In extreme slipping there is complete detachment and rotation of the femoral head which, at times, amounts to 90 degrees and the associated extreme anteversion of the neck.

In the acute form of the condition there is usually a history of severe trauma with the associated clinical symptoms of a fracture; in the chronic variety there may or may not be a clear history of trauma or one of repeated slight injuries which may not be sufficiently severe to incapacitate the patient. In general, then, any injury may completely separate the femoral head and neck and initiate acute symptoms.

In long-standing examples the condition represents the end-results of all stages of the disease in which the epiphysis is united with the neck and the resultant deformity. FRANK L. HUSSEY, M.D.

The Value of X-Rays in the Study of Postoperative Emergencies and Complications. JAMES T. CASE. *Am. J. Surg.*, 1947, 74: 414.

The author presents a series of cases which demonstrate the value of x-ray study in abdominal emergencies and postoperative complications. In the first group of cases are those of intra-abdominal abscess formation.

Case 1 deals with a patient who had recently undergone an operation for drainage of an appendical abscess. The clinical findings suggested further abscess formation. A scout film of the abdomen was inconclusive, although absence of gas shadows in the lower left quadrant suggested this as the site of the abscess. A film taken 5 hours following the ingestion of umbrathor showed the bowel loops displaced from the lower left quadrant in a manner to definitely indicate an abscess in the lower left quadrant of the abdomen.

Case 2 is a similar one in which the condition followed an appendectomy. Visualization of the colon with an opaque enema revealed the cecum and ascending colon to be displaced mesially, leaving a large vacant space on the outer side of the cecocolon which indicated that an abscess was located in this region.

In case 3, a scout film demonstrated the location of an abscess by the presence of an area which was free of gas shadows and later displacement of a barium filled colon verified it.

In the second group of cases roentgenograms are utilized to demonstrate free air under the diaphragm as its cardinal sign. One group of such cases is represented by rupture of a hollow viscus, such as a duodenal ulcer, an ulcer of the colon, etc.

In case 4, films taken in an upright position reveal a small parallel translucent zone beneath the cupola of each diaphragm which indicates the presence of air due to a ruptured viscus.

A case of subphrenic abscess is that of a woman (case 5) who recently had an operation for a suppurating gall bladder. Roentgenograms revealed elevation of the right diaphragm and some irregularity of the diaphragm in the region of the costophrenic angle. There was no fluid level. In the majority of cases of subphrenic abscess there is no evidence of a fluid level. On fluoroscopic examination fixation of the diaphragm and supraphrenic lung field shadows are significant.

Occasionally gas supernatant above the fluid in an abscess is visualized. In case 6 a large gas containing shadow below the right diaphragm indicates the presence of a subphrenic abscess.

In case 7 a lateral position film demonstrates the large right subphrenic abscess. Left subphrenic abscess is considerably less frequent than right.

In case 8, elevation of the left diaphragm, a small pleural effusion, a fluid level with gas above it

below the cupola of the left diaphragm, and visualization of the mesial outline of the abscess by contrast material in the stomach demonstrated a left subdiaphragmatic abscess.

In case 9 a film taken with a drainage tube in a subphrenic abscess illustrated perfect drainage in the absence of a fluid level.

In case 10 a bedside roentgenogram revealed a large subphrenic abscess on the right side which was evacuated. After a few days a colon study revealed the tip of an inverted cecum well up under the edge of the liver and opaque material flowing from the cecum into the drainage tract, thus demonstrating the cause of the abscess as being that of a ruptured subhepatic appendix.

In case 11, the first x-ray film showed flattening and elevation of the cupola of the right diaphragm. On a supine roentgenogram, enlargement of the liver was seen. The findings suggested a liver abscess which was not complicated by an aerogenic organism; 300 c.c. of pus were removed by aspiration. In liver abscess of this type fluoroscopic examination from day to day reveals a decrease in the excursion of the diaphragm followed by a final cessation of excursion of the diaphragm on the liver side. Intravenous injection of thorotrast may be used to help visualize a hepatic abscess. X-rays are of great aid in biliary tract complications. At the time of surgery, the surgeon can introduce some form of opaque material, preferably thorotrast, into the gall bladder or common duct to determine the patency of the duct or the presence of stones. Before removal of drainage tubes from the common duct its patency is determined by the above method.

In case 12 a nonvisualization of the gall bladder following a recent closure of a gall bladder drainage indicated an obstruction in the cystic duct, which at surgery was found to be an inch-long piece of heavy silk. Another group of postoperative cases in which x-rays are of value are those in which there are complications following gastroenterostomy, such as simple invagination of one loop or of double loop invagination of a small bowel into the stomach through the gastroenterostomy stoma.

In cases 13 and 15, jejunogastric invagination was demonstrated on filling the partially resected stomach with barium.

In case 14 a stenosis at the site of the stoma was demonstrated by visualization of dilatation of the duodenum and upper jejunum on x-ray examination.

Another group of cases of x-ray interest are those of intestinal obstruction. In cases 16 and 17, which were similar, the colon was seen to be markedly distended; this was relieved by enema.

Case 18 was one of acute obstruction of the small intestine following operation. In this case characteristic stepladder or parallel arrangement of the coils of small bowel was seen. The coils of small bowel are easily recognized due to the herringbone appearance produced by the valvulae conniventes. Fluid levels in the bowel may be demonstrated by upright or lateral reclining films. A small amount of barium or umbrathor may be used to visualize the small bowel more distinctly, but is not considered necessary.

Films of cases 19 and 20 demonstrate the use of umbrathor or barium. Intubation of the small bowel, which has become quite popular, should be controlled by x-ray study. The use of the tube is attended, however, by a certain danger because of delay. FRANK L. HUSSEY, M.D.

MISCELLANEOUS

Preparation of Radioautographs of Thyroid Tumors for Study of High Magnification. TITUS C. EVANS. *Radiology*, 1947, 49: 206.

In the usual procedure of preparing radioautographs, the tissue section, mounted on a microscopic slide, is placed against a photographic emulsion for a suitable time in the dark. After the proper exposure the two are separated. The photographic image is developed, the microscopic section is stained and a comparative study is made.

A closer contact between the tissue and the photographic emulsion, however, seems desirable. It occurred to the author that the mounting of the tissue section directly on the photographic plate might be advantageous. With this view in mind he elaborated a technique which is similar to that used in preparing histologic slides when paraffin sections are floated onto the microscopic slide. The technique is described in detail.

The present article is limited to radioautographs of thyroid tumors containing radioiodine but the method is applicable to other radioactive substances and other tissues as well. The Eastman median contrast lantern side plates were found to be the most satisfactory for the autographs. The 2 by 2 inch size is used when the tissue layer is floated on the plate and the 3¼ by 4¼ inch size when the microscope slide containing the tissue is taped to the plate, as in the older method. It is best to produce both types of autographs to obtain a comparative study.

The author cites several cases in which the method has been used to advantage and presents several photomicrographs and autographs prepared by both techniques to prove the point. In the newly described technique proper alignment is automatic and a higher magnification with good detail is possible, because the tissue is not removed from the photographic plate. As one changes from low power to high power the plane of the tissue section and of the autograph becomes distinctly separate.

Thus by mounting the tissue directly on the photographic plate, one obtains a differential "staining" of either large or minute regions that have taken up the radioactive iodine. This helps in the study of thyroid function and may aid in determining whether or not a certain case of thyroid neoplasia should be treated with radioactive iodine.

T. LEUCUTIA, M.D.

The Metabolism of the Fission Products and the Heaviest Elements. Jos. G. HAMILTON. *Radiology*, 1947, 49: 325.

Fission products getting into the body are dangerous because the quantities which are dangerous are minute compared with those necessary to produce damage by external beta or gamma irradiation. The fission of uranium results in the production of 34 radioactive elements from zinc to europium as well as nearly 200 known isotopes of these 34 elements.

This is a study of the absorption, distribution, retention, and excretion of these radioactive elements. In addition, the behavior of these radioactive elements was observed following their introduction into the body by the 3 major portals of entry; namely, inhalation, oral ingestion, and through cuts and abrasions of the skin. This study is important because very little is known about the metabolism of the radioactive elements involved. The fission products included in this report were strontium, yttrium, zirconium, columbium, ruthenium, tellurium, iodine, xenon, cesium, barium, lantharium, cerium, praseodymium, and element 61. The studies are being extended to include others of the fission products and eventually it is planned to include them all. Plutonium and the actinide elements (heaviest elements) were also studied.

The method used was to do tracer studies on rats following oral ingestion, inhalation, and parenteral injection of these elements. The absorption, distribution, retention, and excretion of each substance were determined and radioautographic studies were made if there was a high degree of selective absorption to correlate an accumulation of the radioactive elements with the microscopical anatomy.

Only 5 of the fission products included in this study were absorbed to a significant degree from the digestive tract. These were strontium, barium, tellurium, cesium, and iodine, the latter being absorbed completely. The absorption from the lungs was discussed but the most significant feature appeared to be the metabolic patterns observed following parenteral administration.

There was a surprising predilection to prompt deposition and prolonged retention in the skeleton of many of the long life fission products and the actinide elements. The radioautographs of these elements showed that all of these elements that accumulated in the bone, except strontium, are not deposited in the mineral structure of the bone but rather appear to be localized in and adjacent to the osteoid matrix; thus the radiation was brought in close contact with the radiosensitive bone marrow. It was noted that lantharium, cerium, praseodymium, element 61, americum, and curium have a rather large fraction deposited in the liver. All of the elements except columbium accumulated in bone and were released at a very slow rate.

STUART A. PATTERSON, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Homologous Serum Jaundice. I. Jay Brightman and Robert F. Korns. *J. Am. M. Ass.*, 1947, 135: 268.

The ready availability of pooled plasma, whether secured through commercial channels, state departments of health, or local blood banks has been a boon to medical practice. However, the fact that plasma may carry a virus capable of inducing hepatitis in the recipient has created a new public health problem of major importance.

Follow-up of 649 patients who received transfusions with dried pooled plasma revealed a subsequent incidence of homologous serum jaundice in 4.5 per cent of the patients.

The causative agent appeared to be widely distributed, but the rate of attack was variable.

It was significantly higher among persons who were 50 years of age or more. No relation of the attack rate to the amount of plasma administered could be demonstrated.

Investigation of 51 deaths attributed to acute hepatitis revealed 15 cases in which the patients had received transfusion therapy during the 6 months prior to death. Twelve of these had received plasma only.

Twelve deaths attributable to homologous serum jaundice were reported in Upstate New York during a 7 month period.

Plasma, as well as other forms of transfusion therapy, should be administered only when the clinical indications are absolute, so that the benefits to be derived clearly outweigh the risk of contracting homologous serum jaundice.

Immediate, intensive research toward the elimination of the causative agent is imperative.

Harry W. Fink, M.D.

Ascariasis as a Surgical Disease (Ein Beitrag zur Askaridiasis als chirurgische Erkrankung). Norbert Zylka. *Deut. med. Wschr.*, 1947, 72: 417.

Shortage of anthelminthic drugs and the extensive use of manure in place of artificial fertilizer are responsible for the great frequency of ascariasis among German children. The author was able to establish the diagnosis of infestation with ascaris in 1 of each 3 children in his institution.

In the course of a year, ileus caused by ascaris worms required an operation in 5 patients, 3 children and 2 adults. An ascent of the worms into the biliary ducts was not observed. In several instances the worms evidently reached the stomach because they were found in the vomitus. The third grave complication, namely, a penetration of the intestinal wall with subsequent peritonitis, was not observed by the author.

In a 34 year old man not less than 1,200 worms produced within the intestines a mass 1 meter long. All of the patients recovered from the operation, which consisted of an enterotomy and removal of the worms.

Joseph K. Narat, M.D.

Two Cases of Primary Suppurative Psoas Myositis. Eino E. Vuori. *Acta chir. scand.*, 1947, 96: 87.

Primary suppurative myositis is a purulent inflammation occurring both in the parenchyma and in the interstitial connective tissue of a muscle and is limited by the muscular fascia. It occurs in patients who present no associated concurrent disease in other parts of the body. Myositis occurs most commonly in one muscle. In the psoas region a primary suppurative myositis is rare, but secondary myositis is frequent.

The first case was that of a woman 22 years old. Two months before admission the patient fell on her seat on slippery ice. After some days pain "inside the pelvis" started; it increased daily and caused a limp in the right leg. Walking was easiest in the bent position. Fever began at the same time. The symptoms disappeared almost completely with bed rest and heat although there still was a limp. On admission she had fever, spastic flexion contracture of the right thigh to about 60 degrees, severe pain on attempted extension of the thigh, and a palpable tender mass in the iliac fossa. The right psoas shadow did not show on roentgenographic examination. A diagnosis of an abscess of the psoas muscle was made and it was drained operatively. The organism was a staphylococcus. Two days later the temperature was normal and the contracture relaxed. A follow-up 9 months later showed no residual difficulty.

The second case was that of a man 22 years old. Three weeks previous to examination a pain had begun spontaneously on the right side, deep in the lumbar region; it gradually increased. Also, gradually increasing limp was apparent until the patient was unable to walk on admission. He had a fever, slight flexion contracture of the right thigh, pain on attempted extension, pain on pressure at the base of the right thigh on the medial aspect, and a mass on the right side. The abscess was drained through the back. In 2 days the temperature was normal. A follow-up 5 months later revealed no marked residual difficulty. The organism was a staphylococcus.

Similarly, as in these 2 cases, the causative organism reported in the literature has been the staphylococcus, most commonly the staphylococcus aureus. The streptococcus, pneumococcus, or Pfeiffer's bacillus influenzae has rarely been the cause of the disease. The point of entry has sometimes been a small infected excoriation or an acne pustule; tonsils have been suspected; and the appendix has been indicted. Most of the conditions have been on the right side. Small hematomas arising in connection with muscle trauma are probably predisposing factors; also, very strenuous work. The infection may spread into the

muscle by the hematogenous as well as the lymphatic route.

The most important symptoms are fever, often high and septic, consequent impairment of the general condition, and a swollen and tender muscle tumor without peritoneal irritation but accompanied by a spastic flexion contracture of the thigh with slight outward rotation. The only movement which causes pain is extension of the thigh and this may be considered pathognomonic of the disease.

Complications that may occur are collateral periureteritis or displacement of the kidney with secondary temporary hydronephrosis; perforation into the peritoneum, intestine, or bladder, extension below the inguinal ligament, meningitis from penetration of the dura; and metastatic infections.

In the differential diagnosis the following diseases should be considered: purulent coxitis, abscesses descending from tuberculous or nontuberculous spondylitis, osteomyelitis of the ileum, purulent iliosacral arthritis, and periappendicular and pararenal abscesses. All the bone and joint lesions should be differentiated by x-ray study as well as clinical manifestations. Periappendicular abscesses do not cause contracture of the psoas muscle as a rule whereas pararenal abscesses may cause even a severe psoas contracture. The latter differential diagnosis may be impossible but the treatment is the same as far as the abscesses are concerned.

Treatment is extraperitoneal incision and drainage of the abscess. The incision is made from the back above the crest of the ilium if the position of the abscess is high, but from the front in cases of low abscesses. As the causative organisms are generally staphylococci and less often streptococci, and only in rare instances other bacteria, recovery may probably be brought about by the use of sulfonamides or penicillin alone if administration is early. The prognosis is excellent if the patient receives proper treatment. LEROY J. KLEINSASSER, M.D.

Tropical Ulcer. J. A. LICHTMAN. *Clin. Proc.*, Cape Town, 1947, 6: 165.

In 1945 the writer encountered a prevalent form of leg ulcer in the Natal Bantu which, since 1944, has been referred to here as "tropical ulcer." This ulcer has been described under numerous other names by various authors in the past.

The author observed 160 of these ulcers personally. The majority were chronic with a duration of from 1 to 2 months. The ulcer probably begins as an infection of a wound or sore or as a spontaneous vesicle which bursts in a few days. It usually occurs on the lower extremity below the knee. The most common sites are the anterior surface of the tibia, over the malleoli or over the dorsum of the foot. Pain was usually present but not severe. A fetid odor was characteristic. The edges of the ulcer were raised and indurated. The base was firm and adherent. A tenacious, yellowish gray slough covered the floor. Beneath this, granulation tissue was exuberant. An abundant sanguineous discharge was often present. The shape of the ulcer was often irregular or the ulcer was undermined, which suggested a local acute exacerbation of a chronic process. Extension in depth was common. Multiple ulcers were often present close together—an example of autoinoculation. Lymphatic spread, toxemia, septicemia, and fever were conspicuously absent. Malignant transformation was not encountered. The surrounding skin often showed pigmentation, "crazy paving" (signs of vitamin B deficiency), and scars of previous ulcers (one ulcer did not confer immunity).

The immediate cause of an ulcer is a localized defective blood supply, usually due to inflammation and infection. Various bacteria were found in these ulcers but the most common and constant were fusiform bacilli and spirochetes. Diphtheria or diphtherialike organisms were never found, in contrast with veld sore. Leishman-Donovan bodies and mycotic organisms were not found. The fusiform bacilli and spirochetes were morphologically identical with those of Vincent's angina bacillus. The frequent presence of these organisms is evidence that they were pathogenically causal and not merely saprophytic. When they were absent the patient was under active treatment or the ulcer was atypical. Other authors have often noted the presence of these organisms with the type of ulcer described. Saprophytic organisms do not invade living tissues, but in tropical ulcers various authors have noted the invasion of living tissue by spirochetes or fusiform bacilli. Tropical ulcers have been produced in volunteers by using pure cultures of fusiform bacilli. A transiently positive Wassermann reaction may occur in tropical ulcer. This has been demonstrated in cases of tropical ulcer from which pure cultures of fusiform bacilli were obtained.

Frank trauma, insect bites, and infestations are important in initiating an ulcer. Fusospirochetal organisms are common in normal and diseased mouths. The mouth has often been assumed to be the reservoir of the organisms of tropical ulcer —the mode of infection being promiscuous expectoration or intentional application of saliva as a hemostatic to an injury. The clinical and bacteriological features of human bites are seen to resemble tropical ulcer closely. Insects may mechanically transmit the organisms. The soil and water have been believed to harbor them; this may explain the usual occurrence on the legs.

Customs of dress and increased skin moisture may explain why the ulcers are confined to hot climates. There is a definite autumnal increase of these ulcers. This has been linked to dietary deficiency of protein and vitamins which is corrected during the winter.

Syphilis has been suggested as a cause for tropical ulcer. However, the finding of a positive Wassermann reaction assumes less importance when it is considered that a large proportion of the native population suffers from syphilis or yaws. Besides, many cases of tropical ulcer give a negative reaction. All of the author's cases had negative blood smears for malaria. The stools in this series were negative for

hookworm ova and the urines for bilharzic ova. It is possible that sickle cell anemia predisposes to tropical ulcers.

A dietary deficiency of calcium has been linked to an increased incidence of tropical ulcer. In the author's series avitaminosis was common among the controls but it was more marked in the ulcer cases. He believes a deficiency of nicotinic acid and riboflavin is an important predisposing cause. These vitamins are of great importance in the transfer of oxygen to living cells. Fusiform bacilli are anaerobic. Hence it is postulated that *in the competition for blood oxygen, the fusiform bacilli are at a considerable advantage when these vitamins, viz., nicotinic acid and riboflavin, are deficient.*

With regard to age, school children predominated in the author's series. This may have been due to the teachers' sending them to the hospital. Males were found more frequently in the ratio of 14 to 9. This may reflect the traumatic factor. Interestingly, in the autumnal ulcer season, when dietetic factors are important, the sex incidence is almost equal.

In summary, fusospirochetal organisms are believed to be the exciting cause of tropical ulcer. Access to tissues is gained through trauma to which the legs are prone. Deficiency of nicotinic acid and riboflavin is believed to be an important predisposing cause in that these deficiencies predispose to an anaerobic condition in the tissues.

JAMES WEAVER, M.D

Paths of Cancer Biotherapy. N. G. KLYUEVA. *Am. Rev. Soviet M.*, 1947, 4: 408.

Biotherapy of malignant neoplasms falls into 3 categories:

1. The action of folic acid. Prolonged use of folic acid has caused a regression of mammary cancer in 40 per cent of treated mice. No information is available regarding its effectiveness in the treatment of cancer in human beings.

2. The action of products of bacterial origin. The polysaccharide fraction from the Bacillus prodigiosus proved to be highly toxic to animals and man. Its injection was followed by fever, fall of the blood pressure, anuria, cardiac decompensation, and collapse. It appears that products of bacterial origin, at present, fail to give positive results.

3. The action of the South American trypanosome, Schizotrypanum cruzi. In a normal animal, trypanosomes multiply in the heart, spleen, liver, bone marrow, and lymph glands. In an animal with malignant growth, the trypanosomes are absent from these organs, and are concentrated in the neoplasm. They multiply there in large numbers and are often found within the cell.

The experiments made on white mice with transplanted sarcoma 180 showed that the strain had a potent inhibitory action. The degree of inhibition was directly proportional to the duration of the trypanosome infection. From 7 to 8 days after the injection of trypanosomes, a cessation of tumor growth could be noticed. On the eleventh day, 50 per cent of the animals had no tumors, and 14 days later 85 per cent of the animals showed tumor regression, while 92 per cent of the control groups showed actively growing sarcomas. The author reports the use of the cancerolytic substance KR; favorable results were obtained in 10 patients with cancer of the larynx, in 3 with cancer of the cervix, and in 3 with cancer of the breast.

TABLE OF COMPARISON

Anticancer substance KR	Polysaccharide fraction
1. Is contained in the body of the trypanosome schizotrypanum.	1. Is contained in the filtrates of the culture of the Bacillus prodigiosus.
2. Acts on cells of an experimental, implanted sarcoma, cancer, and spontaneous adenocarcinoma.	2. The same.
3. Destroys cells of malignant human neoplasms.	3. Inconclusive.
4. Effect directly proportional to the dosage of the injected substance and the number of injections.	4. Effect directly proportional to the dose of the injected substance and inversely proportional to the number of injections.
5. Disintegration of the nucleus and protoplasm of the cancer cell into separate fragments, lysis of the cell, and replacement by connective tissue.	5. Formation of a hemorrhage in the cancer and a necrosis of the cancer cells.
6. Parenteral introduction of cancerolytic doses into man is not toxic.	6. Therapeutic doses are highly toxic.
7. Extracted from the body of the trypanosomes together with a protein and carbohydrate fraction.	7. Represents a molecule of a polysaccharide.

TABLE OF CONCENTRATION OF KR AND DOSAGE

1. Number of cells in 1 c.c. of the host's plasma —5,000,000
2. Number of cancerolytic units (C.U.) in 1 c.c. of the host's plasma—5
3. Dosage of one injection (in units)—from 30 to 35.
4. Maximal number of injections in a course of biotherapy (in units) —from 45 to 50
5. Maximal number of cells used in one course of treatment—755,000,000
6. Maximal doses of KR given in one course (in units)—755

The experiments showed two phases: (1) regression and absorption of the malignant tissue following the action of the cancerolytic substance, schizotrypa-

num (known as KR), and (2) regeneration, shown by an increase in fibroblasts and of fibrosis. The correlation of cancerolysis and of fibrosis determines the outline of the biotherapy.

LEE PULLEN, M.D.

EXPERIMENTAL SURGERY

Homotransplantation of Fetal Skin. DONALD E. BARKER. *Arch. Path.*, Chic., 1947, 44: 166.

Because of the previously reported conflicting results in the homotransplantation of fetal skin an attempt was made to compare the results of homotransplantation of fetal and adult skin. Black and white guinea pigs weighing from 8 to 13 ounces were used as recipients. A 1 millimeter square of black skin from each fetus and each adult was transplanted to a white rump area. The fetal skin was obtained from fetuses 1 to 7 cm. in length immediately after cesarean section. For the transplantation of adult skin, guinea pigs from 4 to 5 months of age were used.

It is apparent, from the results obtained in this series of experiments, that the younger fetal skin is not as well prepared to withstand transplantation as the older fetal skin. The percentage of primary takes when the older fetal tissues were used was comparable with that attained when adult tissue was used. The main difference between older fetal tissues and adult tissue is that the fetal skin exhibits early proliferation and multiplication of the cells with enlargement of the graft, while the adult grafts usually do not increase in size. In the guinea pig, the use of fetal skin for permanent transplantation is no more successful than that of adult tissue. The early proliferation of such transplanted fetal skin is of short duration and is followed either by a rapid melting away of the graft or by its slow regression.

FRANK F. KANTHAK, M.D.

Pigment Changes in Experimental Whole Thickness Skin Grafts. DONALD E. BARKER. *Arch. Path.*, Chic., 1947, 44: 163.

Previous experimental work by Loeb and others has produced divergent opinions on the invasion of pigment into surrounding tissue after skin grafting. With this in mind, the author has restudied the problem with the use of black and white guinea pigs. The hair was clipped and the skin shaved. With a sterile cork borer 17 mm. in diameter, two circular areas were marked out, one in black and the other in white skin. The skin so outlined was excised and each piece was transferred as a free graft, the black graft to the white area and vice versa. The grafts were sutured in position and dressed with petrolatum gauze and a sea sponge pressure dressing. The dressings were changed at the end of 12 days and the grafts were observed periodically from then on.

In 11 of 50 guinea pigs, takes of both the black and the white grafts were obtained and the observations reported were made on this group of 11 animals. During the first 4 weeks following transplantation the grafts shrank to about one-half their original size. When the shrinkage had ceased the pigment of the black graft gradually invaded the surrounding white area. This extension of the black pigment continued for as long as 93 days. In contrast to this, in all 11 animals the white graft was gradually invaded by the surrounding black pigment until the graft was no longer visible. In 9 of the 11 guinea pigs this invasion of the white graft was completed within 60 to 80 days. The hair growth of the grafts was sparse, but the hair grew out of the grafts in the original direction of the growth. It was noted that in the case of the white grafts, white hair continued to emerge from the grafted area for as long as 5 months even though complete pigmentation of the original white graft had taken place.

FRANK F. KANTHAK, M.D.